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CONTENTS
Volume 22, 2005 Page

Contributed Papers

The lichen genus *Nephroma* in Australia
– Simone HJJ. Louwhoff 3

New Victorian endemic species of *Poa* L. (Poaceae)
– CM. Weiller, V. Stajsic, & NG. Walsh 11

Taxonomic studies in the *Grevillea victoriae* species complex (Proteaceae: Grevilleoideae) I. Descriptions of nine previously segregated, and three new taxa
– V. Stajsic & WM. Molyneux 19

Large is better: the effects of floral display on reproductive success in two populations of *Caladenia (Stegostyla) gracilis* R. Br.
– Raymond Tremblay 77

A new species of *Commersonia* (Malvaceae *s.l.*) from the Eyre Peninsula, South Australia
– CF. Wilkin & BA. Whitlock 87

A new species of *Bulbine* (Asphodelaceae) from Wilsons Promontory and islands of eastern Bass Strait
– Dennis I. Morris & M. Duretto 93

New combinations for two species of *Spyridium* (Rhamnaceae: Pomaderreae) from the Grampians, Victoria
– J. Kellerman 97

A new endemic species of *Hibbertia* (Dilleniaceae) from Tasmania
– AM. Buchanan & RB. Schahinger 105

Lectotypification of *Sclerolaena glabra* (F. Muell.) Domin (Amaranthaceae/Chenopodiaceae)
– N. Walsh 111

Vale Dennis Morris, 1924-2005
– Gintaras Kantvilas 113

Note from the Editor 115

Muelleria **volume 21** was distributed on 24 June, 2005

Mnelleria 22: 3–10 (2005)

The lichen genus *Nephroma* in Australia

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Abstract

A morphological and chemical investigation of Australian species of *Nephroma* reveals four taxa for the continent: *N. australe, N. cellulosum, N. helveticum* and *N. rufum*, and clarifies their chemistry. *Nephroma cellulosum* var. *isidioferum* has been reduced to synonymy with *N. cellulosum*. The distribution for *N. helveticum* in Australia is updated and specimens previously identified as such for Victoria and the ACT are in fact *N. rufum*. A key to, and some taxonomic notes on, the species are provided.

Introduction

Nephroma Ach. in Luyken, 1809 [type *N. arcticum* (L.) Torss.] derives its name from the Greek *Nephros* (kidney), referring to the shape of the apotheeia, which are situated on the lower surface of the lobe apices. Worldwide the genus comprises about 40 species and these are distributed in the temperate zones of both Northern and Southern Hemispheres (Galloway 1985). Some species are tripartite but the majority is bipartite (Lohtander *et al.* 2002). The term bipartite refers to those species that possess only one photosynthetic component, the cyanobacteria *Nostoc*, which more or less forms a continuous photobiont layer under the upper cortex (Lohtander *et al.* 2002). However, in tripartite species two photosynthetic components are present. The green alga *Coccomyxa* forms the photobiont layer under the upper cortex and the cyanobacteria are confined to cephalodia (variously shaped structures, brain-like in section). These may be present internally in the medulla or externally on the lower surface (Lohtander *et al.* 2002). With the exception of *N. australe*, which has *Coccomyxa* as the dominant green photobiont and *Nostoc*-containing, external cephalodia, the Australian species are bipartite and contain *Nostoc*.

Nephroma (formerly included in the Peltigeraceae) currently is placed in its own family Nephromataceae (Eriksson & Strand 1995, Lohtander *et al.* 2002, Wetmore 1960) and, indeed, molecular data suggest that the Nephromataceae are possibly not closely related to the Peltigeraceae (Eriksson & Strand 1995). Seven broad chemical groupings occur within the genus (James & White 1987, White & James 1988) and three of these have been identified in Australian species (Groups 4, 5 & 6). One of these chemical groups (Group 4) comprises a series of six triterpenoids that also occur in *Peltigera* and this has previously been interpreted as signifying a close chemical relationship with that genus (James & White 1987). Phylogenetic studies (based on mtSSU rDNA and ITS as well as chemical characters) demonstrate that *Peltigera* constitutes the sister group to *Nephroma* (Lohtander *et al.* 2002). However, earlier molecular data did not support a close relationship between the two genera (Eriksson & Strand 1995). As well as chemical groupings, White & James (1988) provide a detailed discussion on morphotypes, reticulation and propagules in *Nephroma*.

Materials and Methods

Terpenes, depsides and depsidones were identified using thin layer chromatography (TLC) in solvent systems C (toluene/acetic acid – 170:30), G (toluene/ethyl acetate/formic acid – 139:83:8) and EHF (diethyl ether/hexane*/formic acid – 300:100:3)

following techniques outlined in Elix & Ernst-Russell (1993) and Orange *et al.* (2001). * Petroleum spirit b.p.60-80 was used in place of hexane for health and cost considerations. Abbreviations for the terpenes follow those used by White & James (1988). All terpenes appear on the TLC plate as dark purple or brown spots after charring, and as bright orange spots with or without a lighter halo when examined under long UV after charring.

T1 = 7β-acetoxyhopan-22-ol
T2 = 15α-acetoxyhopan-22-ol
T3 = hopane-6α, 22-diol (zeorin)
T4 = hopane-7 β, 22-diol
T5 = hopane-15α, 22-diol

Pigments previously referred to as P1-5 by White & James (1988) have now been identified using high performance liquid chromatography (HPLC; Elix *et al.* 2003) and are shown in Table 1. The colour of the spot, and under long wave UV following charring, is also described there.

Table 1. The identity of pigments 1-5 (as referred to in White & James 1988) and selective TLC data.

Pigments 1-5 (White & James 1988)	Pigments identified by HPLC	Spot colour after acid and charring	UV after charring
P1	*O*-Methylleprolomin	Bright yellow	Bright lime
P2	Exuviatic acid A	Green	Dull brown/orange
P3	Iso-*O*-methylleprolomin	Pale yellow	Bright lime
P4	Exuviatic acid C	Green	Dull brown/orange
P5	Exuviatic acid B	Green	Dull brown/orange

The position of secondary compounds found in Australian *Nephroma* species using solvent system G are shown in Figure 1 and the shading/hatching used is consistent with that of White & James (1988) for comparative purposes.

The morphology and anatomy of almost 250 specimens from BM, BRI, CANB, CHR, FH, H, HO, MEL, NSW and US were examined using light microscopy. This included not only Australian collections but also comparative material from other regions, such as the type collections of *N. cellulosum* from Staten Island (syntype – BM, isotype – US), *N. cellulosum* var. *isidioferum* J.S.Murray from New Zealand (holotype – CHR), *N. helveticum* from Switzerland (image of lectotype – H) and *Nephromium sublaevigatum* Nyl. (synonym of *Nephroma helveticum*) from Mexico (lectotype – H). Regrettably the type material of *Nephroma australe* from New Zealand (holotype believed to be in PC) and that of *N. rufum* from New Zealand (lectotype – BM, isolectotype – VER) could not be traced. Ascospores were examined and measured in hand-cut sections mounted in water or dilute KOH for clarity. Pycnoconidia (asexual spores) were examined and measured using a diluted erythrosine solution, which greatly reduces their movement and stains them red, thereby improving clarity.

Key to the Species

1 Thallus tripartite; photobiont green but internal cephalodia containing blue-green algae (*Nostoc*) also present; thallus yellow to green or occasionally olive..... .....*N. australe*
Thallus bipartite; photobiont blue-green; cephalodia absent; thallus red-brown or greyish-brown or bluish 2

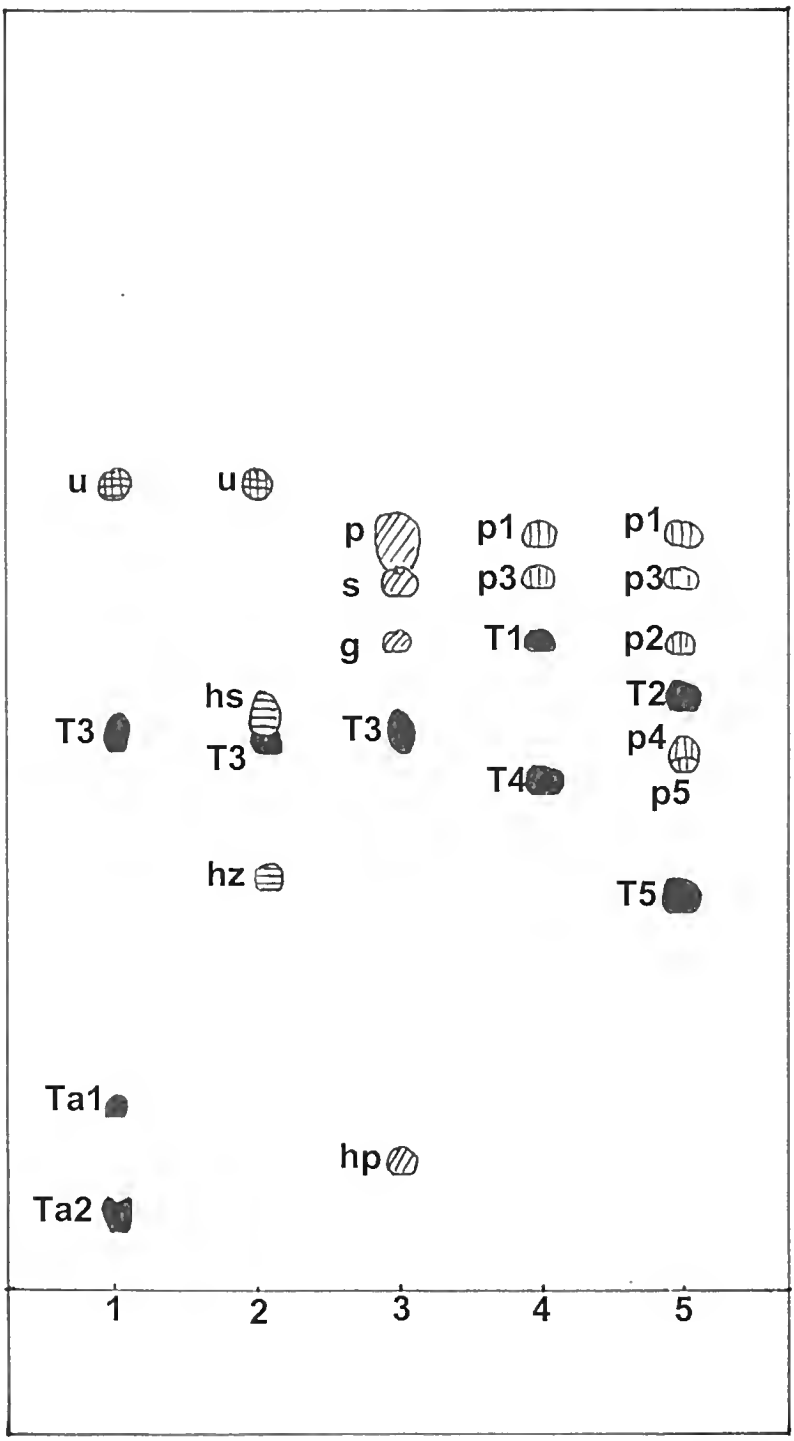

Figure 1. Representation of TLC plate showing position of secondary compounds found in Australian *Nephroma*, using solvent system G. Spots 1-5: 1 = *N. australe* race ii; 2 = *N. australe* race i; 3 = *N. cellulosum*; 4 = *N. helveticum*; 5 = *N. rufum*. P1-P5 are pigments (see Table 1), T1-T5 are terpenes (see materials and methods), Ta1 and Ta2 are associated terpenes (see text *N. australe*). u = usnic acid, hz = hyposalazinic acid, hs = hypostictic acid, p = perlatolic acid, s = stenosporic acid, g = glomelliferic acid, hp = hydrolysis product of perlatolic acid.

2 Upper surfaee strongly faveolate-retieulate; lower surface white, bullate ....*N. cellulosum*
Upper surfaee even or weakly depressed; lower surfaee dark brown or blaek, undulate 3

3 Thallus margins denticulate, ± flattened, with elongate, mostly terete phyllidia, rarely extending to upper surfaee; lower surface tomentose; dorsal surface of apothecia seabrid.....*N. helveticum*
Thallus margins not dentieulate; upper surfaee and margins with scattered or elustered, ± flattened phyllidia; lower surfaee glabrous or occasionally ± subpubescent; dorsal surfaee of apothecia smooth and faveolate.....*N. rufum*

The Species

1. *Nephroma australe* A. Rieh., *Voy. Astrolabe Bot. Pars* 1: 31 (1832)

A detailed deseription of this speeies is given in White & James (1988) and Galloway (1985) and it will be treated in the next *Flora of Australia* liehen series.

Nephroma australe is readily distinguished from the other Australian species by the yellowish or greenish brown (indicative of usnic acid), smooth upper surfaee and by the tripartite nature of the thallus with the dominant green photobiont *Coccomyxa* and *Nostoc*-containing eephalodia. The growth habit varies eonsiderably depending upon the substratum but typieally the sterile lobes are flat and ±attaehed and the fertile lobes are robust, imbricate, upturned and growing away from the substratum.

White & James (1988) reeognise two chemieal races, referred to by Galloway (1985) as ehemodemes (for New Zealand populations), based on the presenee or absence of depsidones (Moroney *et al.* 1981). The majority of Australian specimens belong to ehemical race ii (Figure 1), containing (±) usnie acid, hopane-6α, 22-diol (major), 2 unidentified terpenoids with low Rf (minor), (±) additional unidentified terpenes (trace). Despite being present in signifieant amounts and consistently detectable by TLC, the strueture of the two terpenes with low Rf has not been determined (J.A. Elix, pers. eomm.). Only two speeimens, both from Tasmania (HO 525243, HO 517563), belong to ehemieal raee i (Figure 1) and eontain usnie acid, hopane-6α, 22-diol (major), hypostictie acid (minor) and hyposalazinic acid (minor). Interestingly, these two eollections are from dolerite roeks whereas the other Tasmanian eolleetions, with chemical raee ii, were cortieolous or from other roek types. Additional chemieal variants (e.g. with additional stietie acid) have been reported (from New Zealand and Tasmania) but these are uneommon and have been omitted here, as they do not always give reproduеible results (see also Galloway 1985, White & James 1988). The size of the ascospores reported by White & James (1988) are somewhat larger than those measured for the Australian speeimens in the present study [(22-)24-28 x 7.5-8.5 µm ef. 17-20(-22) x 5-7.5 µm].

Representative specimens examined (total 42): **NEW SOUTH WALES**: Northern Tablelands, headwaters of Edwards Creek, Barrington Tops, 32°04'S, 151°33'E, on *Leptospermum* sp., 28.xii.1965, *R.B. Filson 8023* (MEL 1021147); along road from Barrington to Scone, 1350 m altitude, on *Trochocarpa* sp. in rainforest, 4.vii.1988, *G. Kantvilas 466/88* (NSW 231155); **TASMANIA**: Montezuma Falls Traek, Williamsford end, 41°51'S, 145°30'E, 320 m altitude, on *Nothofagus* in shelter, 4.i.1974, *G.C. Bratt 74/68* (HO 37304); lower slopes of Drys Bluff, 41°41'S, 146°49'E, 500 m altitude, on dolerite rocks in open eucalypt forest, 23.vi.2002, *G. Kantvilas 333/02* (HO 517563); North West, Circular Head, 40°46'S, 145°18'E, *Weymouth 34* (MEL 7368); **VICTORIA**: East Gippsland, Goonmirck Rocks, Errinundra Flora Reserve, 37°17'S, 148°53'E, 1200 m altitude, growing on *Podocarpus lawrencii* in cool temperate rainforest, 29.iii.1988, *J.A. Elix 21890* (MEL 1064421); Eastern Highlands, Federation Traek between Mt Donna Buang and Mt Boobyalla, growing on *Eucalyptus pauciflora*, 21.iii.1965, *R.B. Filson 7042* (MEL 35077).

Nephroma australe is a widespread, austral speeies oeeurring in the eool temperate rainforests of Australasia and southern South Ameriea (Galloway 1985, White & James

1988). In Australia it is known from New South Wales, Victoria and Tasmania (McCarthy 2003), and it is most common and shows greatest diversity in the last state. *Nephroma australe* is corticolous, saxicolous and muscicolous, occurring in cool temperate rainforests.

2. *Nephroma cellulosum* (Sm. ex Ach.) Ach., *Lichenogr. Universalis*: 523 (1810)

Nephroma cellulosum var. *isidioferum* J.S. Murray, *Transactions of the Royal Society of New Zealand* 88: 285 (1960). Type: New Zealand, Otago, Flagstaff, *J.S. Thomson*, 1884 (Holotype – CHR!).

A detailed description of this species is given in White & James [(1988) as *N. cellulosum* var. *cellulosum*] and Galloway (1985) and it will be treated in the next *Flora of Australia* lichen series.

This species is characterised by the robust, orbicular to spreading thallus with olive-brown to reddish-brown, greyish-red or grey (depending on exposure to sunlight), markedly faveolate and ridged upper surface, with or without terete to squamiform phyllidia along the ridges between faveolae, and by the bullate lower surface with whitish, shining margins. The medullary substances include hopane-6α, 22-diol (minor), perlatolic acid (major), glomelliferic acid (major), stenosporic acid (minor), (±) additional traces of glomellic, anziaic and loxodellic acids that are detectable by HPLC but are not always visible on a TLC plate. HPLC has confirmed that the additional low Rf spots sometimes apparent on TLC plates using solvent G (Figure 1) are hydrolysis products of perlatolic acid (J.A. Elix, pers. comm.), as suggested in White & James (1988). The latter authors also report the presence of an occasional yellow pigment in the medulla (K+ purple) but these have not been observed in Australian specimens.

Nephroma cellulosum var. *isidioferum* (syn. *N. lepidophyllum* Räs. ex Gyeln.) has been regarded as distinct from *N. cellulosum* var. *cellulosum* (Galloway 1985, White & James 1988) due to the presence of coarse, terete to squamiform phyllidia along ridges between faveolae, as well as along the margins of lobes and apothecia, and also by an overall greyish bloom in central areas of the thallus (White & James 1988). However, upon closer examination these varieties were found to intergrade in the Australian specimens. The ridges separating the faveolae may become very sharp and this often leads to the cortex rupturing, revealing the medulla. Flatter ridges are less pronounced and do not rupture but are usually still distinctly maculate. Small, terete or broad squamiform phyllidia often, but not always, develop from cracks and maculae on the upper surface. These phyllidia or squamules are considered to be regenerative in nature. They often become undulating and fringed and may develop into young lobes. As many species of *Nephroma* may have them the author follows Wetmore (1960) in considering this character to have little taxonomic significance in the genus. Field studies in Valdivia, Chile by P.W. James indicated that there is a continuum in mixed populations on *Nothofagus* species, with var. *isidioferum* differing only in the production of phyllidia and suppression of apothecia (White & James 1988), which was why these authors only afforded the two taxa varietal status. The type material of *N. cellulosum* does not possess the phyllidiate ridges, whereas that of var. *isidioferum* does. However, it should be noted that much of the type material of *N. cellulosum* was mounted upside down and, in addition, that the specimens were fragmented. White & James (1988) suggest that abundantly fertile material previously determined as var. *cellulosum*, with clustered or scattered phyllidia that are often coralloid, could, in part, also be assigned to var. *isidioferum*. These frequent observations of apparent intermediates, both by this author and others (G. Kantvilas, pers. com., White & James 1988), the regenerative nature of the phyllidia, and the fact that there does not appear to be any difference in distribution and ecology (Galloway 1985 (as *N. lepidophyllum*), Kantvilas & Elix 1992, White & James 1988) or chemistry, suggests that the two varieties form part of the natural variation displayed by *N. cellulosum*.

A preliminary examination of collections from New Zealand, determined as *N. lepidophyllum*, shows that the overall appearance corresponds to that of the Australian

material of *N. cellulosum*. White & James (1988) consider *N. lepidophyllum*, as well as *N. lepidophyllum* f. *hypomelaena* Räs. ex Lamb, to be synonyms of *N. cellulosum* var. *isidioferum*, however, the type material of these two synonyms was not seen for the present study.

Representative specimens examined (total 127): **NEW SOUTH WALES**: Buddong Creek, Forest Way, Bago State Forest, 35°41'S, 148°10'E, 1200 m altitude, on exposed *Eucalyptus*, broad swampy ck, 3.x.1999, *H. Streimann 65327* (CANB 610308.1); Northern Tablelands, headwaters of Edwards Creek, Barrington Tops, 32°04'S, 151°33'E, on *Leptospermum* sp., 28.xii.1965, *R.B. Filson 8022* (MEL 1021144); Swampy Plains River, below Mt. Kosciuszko, 14.ii.1968, *W.A. Weber & D. McVean* s.n. (NSW 524341); **TASMANIA**: Wombat Hill, 41°29'S, 145°27'E, 690 m altitude, on *Cassinia aculeata* in wet scrub at edge of rainforest, 7.xi.1991, *G. Kantvilas et al. 387/91* (HO 63657); near Parrawe, 41°19'S, 145°35'E, on *Cassinia* in shelter, 25.iv.1973, *G.C. Bratt 73/395* (HO 37215); South West, Florentine Valley, 42°40'S, 146°27'E, 17.ii.1974, *M. Westbrook 74/434* (HO 520371); **VICTORIA**: Mt Macedon, v.1885, *F.R.M. Wilson* s.n. (NSW 524344); Midlands, Mt Macedon, Stoney Creek, 37°22'S, 144°34'E, corticolous in rainforest, 26.ix.1987, *R.B. Filson 10307* (MEL 1067038).

Nephroma cellulosum is a widespread austral species occurring in southern temperate South America, including Islas Juan Fernández (Galloway 1985, Redón & Quilhot 1977) and New Zealand (White & James 1988). In Australia it is known from New South Wales, Victoria and Tasmania (Kantvilas & Elix 1992, McCarthy 2003) where it occurs in rainforest, heathland, and high altitude mixed selerophyll and open *Eucalyptus* forest. It is common on corticolous, saxicolous or muscicolous substrata.

3. *Nephroma helveticum* Ach., *Lichenogr. Universalis*: 523 (1810)

A detailed description of this species is given in White & James (1988) and Galloway (1985) and it will be treated in the next *Flora of Australia* lichen series.

This species is characterised by the brown, greyish-brown or pale grey, pubescent upper surface, the predominantly marginal phyllidia and the black or dark brown, tomentose lower surface. It contains hopane-7β, 22-diol (major), (±) 7β-acetoxyhopan-22-ol (minor/trace) and (±) minor amounts or traces of pigments (Figure 1) previously referred to as P1 & P3 (White & James 1988). The nature of these was determined using HPLC and identified as *O*-methylleprolomin (minor/trace: P1), iso-*O*-methylleprolomin (minor/trace: P3). In addition (±) traces of methyl gyrophorate have been detected.

Nephroma helveticum forms a cosmopolitan species aggregate (James & White 1987, White & James 1988, Lohtander *et al.* 2002), which is currently undergoing investigation (White & James 1988). One of the taxa that has been segregated is *N. rufum* (Galloway 1983), distinguishable by phyllidia that initially develop laminally rather than marginally (although they may spread to the margins subsequently), by the non-pubescent upper surface, the glabrous (or rarely subpubescent) lower surface and by the alternative chemistry (terpenes T2 & T5 instead of T1 & T4). *Nephroma helveticum* has been reported to have larger spores than *N. rufum* (15-20 µm *cf.* 20-25 µm) but the spore size did not appear to vary greatly among the Australian specimens.

Representative specimens examined (total 7): **NEW SOUTH WALES**: New England National Park, Point Lookout, 30°29'S, 152°25'E, on *Eucalyptus* trunk on edge of *Nothofagus* forest, x.1967, *D. McVean 67199* (CANB 00578038); Northern Tablelands, headwaters of Edwards Creek, Barrington Tops, 32°04'S, 151°33'E, 28.xii.1965, *R.B. Filson 8022* (MEL 2266605); Central Tablelands, Blue Mountains, 33°30'S, 150°22'E, 310 m altitude, in rainforest country, 26.x.1965, *R.B. Filson 7499* (MEL 1021138); **QUEENSLAND**: Darling Downs, Toowoomba, 27°34'S, 151°57'E, *Hartmann s.n.* (MEL 7370)

Nephroma helveticum is a cosmopolitan species, uncommon in Australia and reported from Queensland, New South Wales, Victoria and the Australian Capital Territory (McCarthy 2003). In the present work this species has been confirmed only for Queensland (rare) and New South Wales. Former records from the Australian Capital

Territory and Victoria are identified as *N. rufum*, which appears to be the more common of the two species. *Nephroma helveticum* is known to be both corticolous and saxicolous but in Australia it has been observed only as growing on bark and twigs.

4. *Nephroma rufum* (C.Bab.) P.James, *New Zealand J. Bot.* 21: 195 (1983)

A detailed description of this species is given in White & James (1988) and Galloway (1985) and it will be treated in the next *Flora of Australia* lichen series.

This species is characterised by the dark reddish-brown, greyish-brown or grey, smooth or ± ridged-faveolate, phyllidiate upper surface and dark brown to black, glabrous or subpubescent lower surface. It contains hopane-15α, 22-diol (major), (±)15α-acetoxyhopan-22-ol (minor/trace), and (±) minor amounts or traces of pigments (Figure 1) previously referred to as P1-5 (White & James 1988, p160). Two of these, *O*-methylleprolomin (P1) and iso-*O*-methylleprolomin (P3), also occur in *N. helveticum* but the exuviatic acids A, B & C (P2, P5 & P4 respectively) have been identified only for *N. rufum*. Although exuviatic acid C (P4) was reported as common for *N. helveticum* (White & James 1988), it was observed only for Australian specimens of *N. rufum*. Methyl gyrophorate and gyrophoric acids were detected in some specimens of *N. rufum* although this was not reported by White & James (1988). *N. rufum* resembles *N. helveticum* but the two are separated by the nature of the lower and upper surfaces, the distribution of the phyllidia and by their chemistry.

Representative specimens examined (total 59): **AUSTRALIAN CAPITAL TERRITORY**: Southern Tablelands, Booroomba Rocks, 35°33'S, 148°58'S, 22.ii.1984, *R.B. Filson 19330* (MEL 1048959); Southern Tablelands, along Gibraltar Creek near Smoker's Gap, 35°31'S, 148°55'E, 1140 m altitude, on *Eucalyptus* sp., 25.xi.1975, *J.A. Elix 1382* (MEL 1017188); **NEW SOUTH WALES:** Brown Mountain, 36°36'S, 149°23'E, 850 m altitude, on granite rocks in wet sclerophyll forest, 6.xii.1978, *J.A. Elix 5459* (CANB 9615083); 5 km NE of Nerriga, along banks of Endrick River, 35°06'S, 150°05'E, 550 m altitude, on shaded sandstone rocks in dry sclerophyll forest, 30.iii.1977, *J.A. Elix 3123* (CANB 9615082); **QUEENSLAND**: Darling Downs, Killarney, 26°46'S, 151°25'E, on tree *F.R.M. Wilson* s.n. (MEL 7369); **VICTORIA**: Otway Ranges, Lorne, 38°31'S, 143°58'E, on rock, *F.R.M. Wilson* s.n. (MEL 7367); **TASMANIA**: Stanhope Colliery near Avoca, 41°43'S, 147°39'E, on dolerite in slight shelter, 25.xi.1970, *G.C. Bratt 70/1392* (HO 37311); Elephant Pass, 41°38'S, 148°14'E, on soil and mudstone in exposed situation, 14.iii.1970, *G.C. Bratt 70/351* (HO 65391).

Nephroma rufum is an Australasian species reported for New Zealand and Australia (Galloway 1985) where it occurs in the Australian Capital Territory, Queensland, New South Wales, Victoria and Tasmania (McCarthy 2003). It most commonly grows on rocks, often among mosses, but also on soil, tree trunks and branches.

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References

Elix, J.A. & Ernst-Russell, K.D. (1993). *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd edn. Australian National University: Canberra.

Elix, J.A., Giralt, M. & Wardlaw, J.H. (2003). New chloro-depsides from the lichen *Dimelaena radiata*. *Bibliotheca Lichenologica* **86**: 1-7.

Eriksson, O. & Strand, A. (1995). Relationships of the genera *Nephroma, Peltigera* and *Solorina* (Peltigerales, Ascomycota) inferred from 18S rDNS sequences. *Systema Ascomycetum* **14**: 33-39.
Galloway, D.J. (1985). *Flora of New Zealand: Lichens*. P.D. Hasselberg, Government Printer: Wellington.
James, P.W. & White, F.J. (1987). Studies on the lichen genus *Nephroma* I. The European and Macaronesian species. *Lichenologist* **19**: 215-268.
Kantvilas, G. & Elix, J.A. (1992). A new species and new records from the Tasmanian lichen flora. *Muelleria* 7: 507-517.
Lohtander, K., Oksanen, I. & Rikkinen, J. (2002). A phylogenetic study of *Nephroma* (lichen-forming Ascomycota). *Mycological Research* **106**: 777-787.
McCarthy, P.M. (2003). *Catalogue of Australian Lichens, Flora of Australia Supplementary Series Number 9*. Australian Biological Resources Study: Canberra.
Moroney, S.E., Ronaldson, K.J., Wilkins, A.L., Green, T.G.A. & James, P.W. (1981). Depsidone constituents from the quintaria group of *Nephroma* species. *Phytochemistry* **20**: 787-789.
Orange, A., James, P.W. & White, F.J. (2001). *Microchemical Methods For The Identification of Lichens*. British Lichen Society.
Redón, J.F. & Quilhot, W.P. (1977). Los liquenes de las Islas de Juan Fernandez. I. Estudio preliminary. *Anales del Museo de Historia Natural de Valparaiso* **10**: 15-26.
Wetmore, C.M. (1960). The lichen genus *Nephroma* in North and Middle America. *Publications of the Museum, Michigan State University, Biological Series* **1**: 369-452.
White, F.J. & James, P.W. (1988). Studies on the genus *Nephroma* II. The southern temperate species. *Lichenologist* **20**: 103-166.

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New Victorian endemic species of *Poa* L. (Poaceae)

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Abstract

Three new Victorian species of *Poa*, *P. amplexicaulis* C.M. Weiller & Stajsic, *P. orthoclada* N.G. Walsh and *P. orba* N.G. Walsh are described and illustrated and their distribution, ecology and conservation status discussed.

Introduction

During the course of preparing descriptions of Australian *Poa* species for the *Flora of Victoria*, vol. 2 (Walsh 1994) and the forthcoming *Flora of Australia* (in ed.), some previously undescribed species have come to light. Two of the species described below (*P. orthoclada* and *P. orba*) were treated erroneously in the *Flora of Victoria* (one as a species now believed to be endemic to Tasmania, the other as an introduction from New Zealand). The other, *P. amplexicaulis* is a novelty endemic to the state of Victoria. The opportunity is taken here to describe these new species so that the names are available for use in the forthcoming volume 44 of *Flora of Australia*.

Taxonomy

1. *Poa amplexicaulis* C.M. Weiller & Stajsic *sp. nov.*

Poa sp. aff *tenera* (Brisbane Ranges), J.H. Ross & N.G. Walsh, Census Vasc. Pl. Victoria 7th edn. 38, 228 (2003).

A *P. tenera* vaginis rubris, ligula amplexicauli, caulibus brevibus, erectis vel suberectis vel planta caespitosa, lemmate glabro plerumque nervato indistincte differt.

Type: 9 km W of Bacchus Marsh, just S of Ballarat – Melbourne railway line, 13.x. 1973, *T.B. Muir 5186* (holotype MEL 2138583; isotype CANB).

Slender perennial, caespitose with short suberect stolons. Leaves mostly basal. Culms 14–40 cm high. Mid-culm internodes more or less terete or slightly compressed, glabrous or minutely scabrous immediately below the node, occasionally pigmented. Young shoots intravaginal. Basal leaf sheaths glabrous, strongly reddish and shining, the old sheaths straw-coloured; margins connate for their entire length. Ligule prominent, membranous, usually encircling the culm, decurrent, 0.8–2.6 mm long, smooth, truncate or obtuse (sometimes with an apicule), abaxially sparsely hairy. Leaf blades dull yellow-green or green, occasionally pigmented, folded (the margins usually slightly inrolled), 4–11.5 cm long, 0.2–0.9(–1.3) mm wide when flattened; usually striate; adaxially minutely scabrous; abaxially smooth and glabrous; tip usually tapering and slightly curved to a point or occasionally broad and hooded. Inflorescence narrow, 35–100 mm long. Spikelets with 2–7 florets, 2.8–6.2 mm long, green tinged purple or rarely entirely purple. Glumes partly or entirely pigmented, subequal, 1/2–2/3 the length of the proximal lemma, acute, keel scaberulous, intercostal regions glabrous or scaberulous towards apex; lower glume 1.5–2.1 mm long, 1 or 3 nerved; upper glume 1.7–2.8 mm long, 3 nerved. Lemma 2.3–3 mm long, often with a subapical band of pigment or entirely purple except for a broad colourless band at the apex and a narrow band on the margins, acute to obtuse, 5 nerved, nerves scaberulous in the upper part, glabrous or puberulous on the lower part of the midnerve and towards the base on marginal nerves; intercostal regions glabrous or

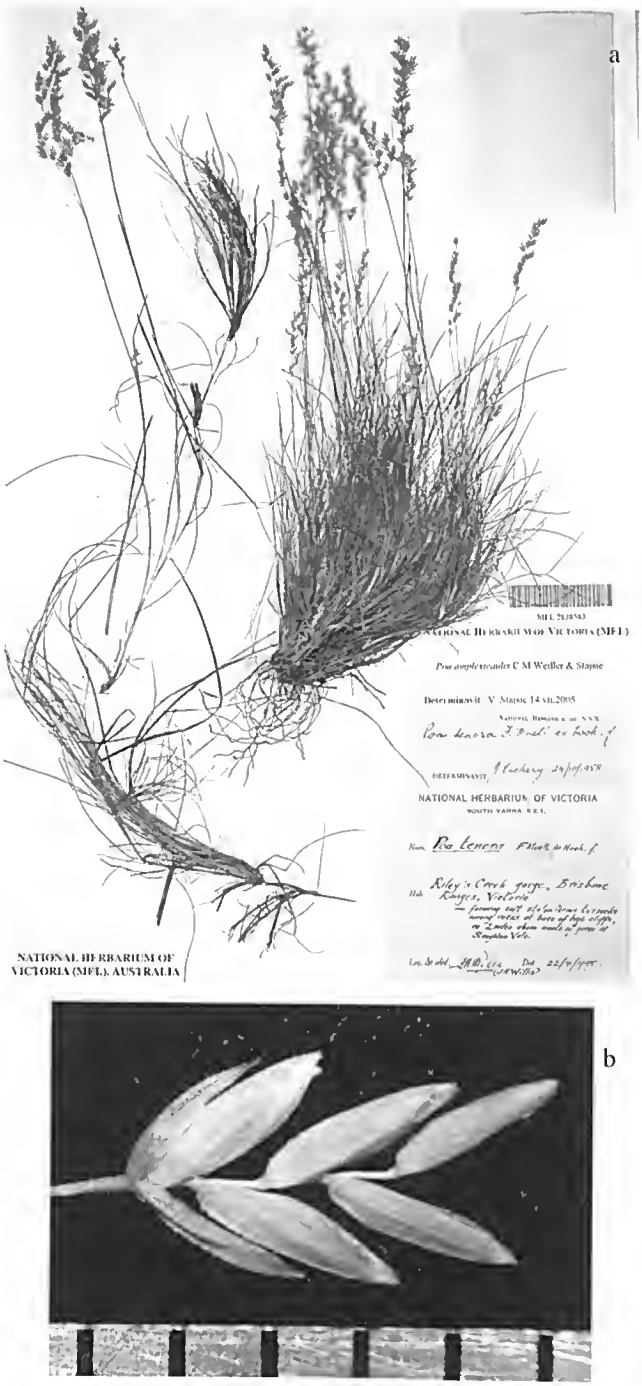

Figure 1. a. *Poa amplexicaulis* speeimen; b. *Poa amplexicaulis* spikelet (all from Willis s.n., MEL 2138583). Scale interval 1 mm

scaberulous towards apex; web absent. Palea slightly shorter than its lemma, glabrous. Anthers 1.1–1.4 mm long. (Fig. 1 a,b)

Distribution and habitat: *Poa amplexicaulis* is apparently endemic to the upper Werribee River catchment, south-central Victoria, occurring in the Brisbane Ranges, Werribee Gorge and further north to the Bullengarook area in the Pyrite Range, but apparently absent from the intervening White Elephant Range (where soils are derived from Tertiary deposits). Although it may be a locally dominant grass, it is nationally rare with Risk Code assessed here as 'rare', 2RCi (sensu Briggs & Leigh 1996) or 'near threatened', NT (sensu IUCN 2001). It has been observed to resprout following fire. It occurs in dry open-forests with dominant species including *Eucalyptus tricarpa* (L.A.S. Johnson) L.A.S. Johnson & K.D. Hill, *E. macrorhyncha* F. Muell. ex Benth., *E. goniocalyx* F. Muell. ex Miq., *Astroloma humifusum* (Cav.) R. Br., *Boronia anemonifolia* A. Cunn., *Bossiaea obcordata* (Vent.) Druce, *Brachyloma daphnoides* (Sm.) Benth., *Dillwynia* spp., *Joycea pallida* (R. Br.) H.P. Linder, *Platysace lanceolata* (Labill.) C. Norman, *Pomax umbellata* (Gaertn.) Sol. ex A. Rich., *Pseudanthus orbiculatus* (Muell. Arg.) Halford & R.J.F. Hend. and *Pultenaea gunnii* Benth. subsp. *tuberculata* Corrick. Soils are characteristically shallow, often rocky, derived from Ordovician sediments.

Etymology: The epithet *amplexicaulis* (Latin *amplexus* - to encircle; *caulis* - stem) refers to the connate sheath and culm encircling ligule.

Notes: Distinctive features of *Poa amplexicaulis* are the fully connate, conspicuously red leaf sheaths, and the distinct membranous ligule decurrent and encircling the culm. This species is referred to by Walsh (1994, p. 424) in a note under the account of *Poa tenera* F. Muell. ex Hook. f. *Poa amplexicaulis* is further distinguished from typical specimens of *P. tenera* by the sparsely hairy to almost glabrous florets and indistinct lemma nerves.

Specimens examined: Victoria. Brisbane Ranges National Park – Stony Ck, from picnic ground on Switchback Rd to Lower Reservoir, 23 Nov. 1977, *E.G. Errey 1295A* (MEL); McCleans H'Way E of Switchback Rd junction, 6.5 km N of Anakie, 1 Oct. 1977, *A.C. Beauglehole 56606 & E.G. Errey* (MEL); c. 250 m SW of Aeroplane Rd turnoff on Reids Rd, 26 Oct. 1992, *V. Stajsic 617, D.E. Albrecht & I.C. Clarke* (HO, K, MEL, S); NE corner near intersection of Aeroplane Rd and Mt Wallace Rd, 26 Dec. 1991, *V. Stajsic 415 & P. Wlodarczyk* (HO, K, MEL, S); Bacchus Marsh Rd junction of Aeroplane Rd, 6 km NE of Mt Wallace Primary School, 2 Oct. 1977, *A.C. Beauglehole 56758 & E.G. Errey* (MEL, NPS, RSA); Just off the Melton-Gisborne Rd, between Gisborne and Toolern Vale, 20 Nov.1992, *V. Stajsic 669* (AD, BRI, K, MEL, NSW); Werribee Gorge State Park, Ironbark (Ingliston) Rd, c. 12 km E of Ballan, 15 Aug. 2001, *N.G. Walsh 5361* (MEL).

2. *Poa orthoclada* N.G.Walsh *sp. nov.*

Poa sp. aff. *gunnii*, J.H. Ross & N.G. Walsh, Census Vasc. Pl. Victoria 7th edn. 37, 228 (2003).

Poa fawcettiae Vickery affinis caulibus erectis rigidis ramosis, foliis erectis tenuioribus brevioribus, ligula membranacea longiore, flosculis glabris vel glabriusculis differt.

Type: Victoria, Snowfields. Alpine National Park, Wonnangatta-Moroka Unit. Foot of Neilsons Crag (The Watchtower), c. 7.7 km NE from Mt Arbuckle, 15.xii.2000 *N.G. Walsh* 5272, (holotype MEL 2089860; isotypes CANB, NSW).

Slender perennial, caespitose, stems usually stiffly ascending with intravaginal branching above base. Leaves basal and cauline. Culms erect, to c. 60 cm high. Mid-culm internodes more or less terete or weakly biconvex, glabrous, smooth, rarely scaberulous, often purplish. Sheaths glabrous, smooth, usually purplish-pigmented; margins connate for up to c. 1/4 of their length. Ligule 0.3–1 mm long, thinly membranous, truncate, distinctly ciliate at apex with cilia c. 0.2 mm long, abaxially ciliolate. Leaf blades dull slaty green, bluish, or distinctly pruinose, inrolled-terete (rarely closely folded), usually stiffly erect, mostly 6–15 (rarely to 40) cm long, c. 0.5 mm diam. (to 1.2 mm wide when flattened), generally smooth but usually minutely scaberulous on margins and near apex. Inflorescence a narrow panicle, to 15 cm long and 8 cm wide, but commonly under 8 cm

Figure 2. a. *Poa orthoclada* holotype; b. *Poa orthoclada* spikelet (from holotype). Scale interval 1 mm.

long and 4 cm wide. Spikelets 3–7-flowered, 4–6 mm long, green or, more commonly, tinged purple. Glumes often shining, 1.8–2.4 mm long, subequal or the lower slightly shorter than upper, both 3-nerved and scaberulous along the keel. Lemma 1.6–3 mm long, relatively narrow, oblong to narrowly oblong-ovate in profile, 2–3 mm long, 5-nerved, nerves smooth or the midnerve minutely and sparsely scabrous, wholly glabrous, or puberulous on the lower part of the midnerve and, rarely, lateral nerves; intercostal regions glabrous; web absent or very weakly developed usually on only the lowermost lemma(s) within a spikelet. Anthers 1.4–1.8 mm long. (Fig. 2 a,b)

Distribution and habitat: Endemic in eastern Victoria where apparently confined to catchments of the Macalister, Avon, Moroka and Wonnangatta Rivers, in an area bounded roughly by Heyfield in the south, Dargo to the east and The Bluff to the northwest. Although rare at a national level, *P. orthoclada* is locally common and sometimes the dominant grass. It is well represented in the Alpine National Park, Wonnangatta-Moroka Unit. Its Risk Code is assessed here as 'rare', 2RCa (*sensu* Briggs & Leigh 1996) or 'near threatened', NT (*sensu* IUCN 2001). Grows in well drained, typically elevated and rocky sites supporting dry woodland dominated by e.g. *Eucalyptus dives* Schauer, *E. glaucescens* Maiden & Blakely, *E. panciflora* Sieber ex Spreng., *E. polyanthemos* Schauer, *E. sieberi* L.A.S. Johnson, or occasionally in rocky outcrop shrublands of e.g. *Calytrix tetragona* Labill., *Leptospermum brevipes* F. Muell. Recorded altitudes range from 150 to 1520 m a.s.l., and soils are typically shallow to skeletal and derived from Carboniferous, Devonian or Ordovician sandstones, shales or conglomerates, sometimes serpentinitic.

Etymology: The epithet (Greek *orthos* – upright; *clados* – branch) refers to the stiff, more or less erect stolons or branched culms.

Notes: Superficially resembles *P. fawcettiae*, but distinguished from that species by the stiffly erect, branching stems, the finer and usually shorter, erect leaf blades, the longer membranous and ciliate ligule and the more or less glabrous florets. It also resembles *P. amplexicaulis*, described above, but differs from that in the narrower, inrolled, stiffer, often bluish leaf blades, the leaf sheaths that are only shortly connate, and the shorter, ciliate ligule.

The species was treated by Walsh (1994, p. 425) as *Poa gunnii* Vickery but reference to a larger suite of material of that Tasmanian species has shown the new species to differ in a number of characters (e.g. erect, branching habit of the culms, shorter ligules, ±pruinose leaf-blades, generally shorter glumes and lemmas and shorter anthers).

Representative specimens (23 specimens examined): Macalister River Catchment – Dolodrook River, 25 Oct. 1972, E.A. Chesterfield (MEL); Spur between Peters Ck and Macalister R., 19 Nov. 1973, E.A. Chesterfield (MEL); W of Glenfalloch, 3 Nov. 1973, E.A. Chesterfield (MEL); Mt Hump, 5 Jan. 1974, E.A. Chesterfield (MEL). Gippsland Lakes Hinterland Study Area – Glenmaggie Regional Park, 21 Oct. 1984, A.C. Beauglehole 78686 (MEL, BRI). Eastern Highlands, E of Mt Eliza Gap, 15 Nov. 1992, E.A. Chesterfield 3510 (CANB, MEL). Alpine, c. 1.5 km SE of the main Snowy Bluff summit 18 Mar. 1992, D.E. Albrecht 4928 (MEL).

3. *Poa orba* N.G. Walsh *sp. nov.*

Poa colensoi auct. non Hook. f.; J.H.Willis, *Handb. Vasc. Pl. Victoria* 1: 100 (1970); N.G.Walsh, *Fl. Victoria* 2:415, 418 (1994); J.H.Ross & N.G.Walsh, *Census Vasc. Pl. Victoria*, 7th edn, 37, 228 (2003)

Poa fawcettiae Vickery similis sed laminis foliorum latioribus brevioribus, ligula longiore, rhizomatibus faecientibus, lemmatis glabris differt.

Type: Victoria, Eastern Highlands. Shores of Lake Omeo, Benambra, 9.xi.1939, *R.A. Black*, herb. No 1235.008(7) (holotype MEL 2021761).

Rhizomatous perennial, producing (often remote) slender leafy tufts; rhizome internodes sometimes slightly swollen. Leaves all basal. Culms 5–15 cm high. Mid-culm internodes glabrous, often slightly compressed. Young shoots extravaginal. Basal leaf sheaths glabrous, not coloured or slightly purpled, margins connate near base, glabrous,

Figure 3. a. *Poa orba* holotype; b. *Poa orba* spikelet (from holotype). Scale interval 1 mm.

smooth; ligule 0.9–3.5 mm long, truncate to obtuse, sometimes shallowly lacerate, apically glabrous, abaxially minutely puberulous. Leaf blades channelled to closely folded, sometimes ±biconvex, 4–8 cm long, 0.8–1.5 mm wide (to 3 mm wide when flattened), stiff, glaucous, adaxially papillose to puberulous, abaxially glabrous, sometimes minutely scabrous near margins, narrowly hooded and pointed at apex. Panicles somewhat contracted to open, 2–6 cm long. Spikelets with (2–) 3–5 florets, 4–7 mm long. Glumes pale or slightly purpled; lower glume 1- or 3-nerved, 1.9–2.7 mm long; upper glume 3- or 5-nerved, 2.1–2.9 mm long. Lemma 2.3–3.2 mm long, 5–7-nerved, often with a subapical pigmented band, occasionally nearly all purple or sometimes entirely devoid of purple pigment; 5-nerved, nerves smooth and glabrous throughout or the midnerve sparsely and minutely scabrous toward the apex; intercostal regions smooth and glabrous; web absent. Palea subequal to or slightly longer than its lemma, scabrous-ciliate along keels. Anthers 1.2–1.6 mm long. (Fig. 3 a,b)

Distribution and habitat: Poa orba is endemic in Victoria and known only from the shores and topographically higher ground of the bed of Lake Omeo, Benambra where it is locally dominant. The lake (usually dry) forms a large part of the town common and is used for cattle grazing. The local airstrip occupies part of the lake perimeter. *Poa orba* is here considered to be 'vulnerable', with Risk Code assessed as 2Vi (sensu Briggs & Leigh 1996) or VU C1+2a(i,ii); D1+2 (sensu IUCN 2001). It grows in stony, cracking calcareous clay soil at c. 700 m altitude in a low halophytic herbfield with *Pelargonium* sp. 1 (*sensu* Smith & Walsh 1999), *Samolus repens* (J.R. Forst. & G. Forst.) Pers., *Schoenus nitens* (R. Br.) Poir. ex Roem. & Schult., and *Wilsonia rotundifolia* Hook.

Etymology: The epithet (Latin, *orbus* – an orphan) alludes to its long rejection as an indigenous plant by Victorian botanists, and also to its unclear phylogenetic relationship to other native *Poa* species.

Notes: This species has previously been regarded as a form of *Poa colensoi* Hook. f. and presumed to have been introduced from New Zealand where that species is native. However it differs significantly in the presence of rhizomes, and in the lack of a distinct abscission line at the leaf sheath-blade junction, also in its occurrence in a saline or subsaline habitat (*P. colensoi* being unknown from such situations). It superficially resembles native *Poa fawcettiae*, but differs in the rhizomatous habit, short leaf blades, long ligule and quite glabrous lemmas. It does not appear to be very closely related to any known native *Poa* species. It could not be matched with keys or descriptions of any *Poa* species from likely countries of introduction (Europe, S. America, N. America, S. Africa, New Zealand). A number of other species are known to be either restricted to Lake Omeo or have it as one of only a few known localities (e.g. *Lepidium aschersonii* Thell., *Pelargonium* sp. 1, *Senecio georgianus* DC. – presumed extinct, and *Stemmacantha australis* (Gaudich.) Dittrich. – extinct in Victoria), supporting the likelihood of *Poa orba* being a localised endemic.

Specimens examined: (all from the type locality) Vic.: 1 Feb.1944, & 6 Dec.1944, S.G.M. *Fawcett* s.n. (both MEL); *N.G.Walsh 5906* (MEL); *N.G.Walsh 6198* (K, MEL).

References

Briggs, J.D. & Leigh, J.H. (1996). *Rare or Threatened Australian Plants*, CSIRO Publishing: Melbourne.

IUCN (2001). *2001 IUCN Red List Categories and Criteria version 3.1*, IUCN.: Gland, Switzerland.

Smith, L.P. and Walsh, N.G. (1999). '*Pelargonium*', *in* N.G. Walsh & T.J. Entwistle (eds), *Flora of Victoria* volume 4, Melbourne: Inkata Press.

Walsh, N.G. (1994). '*Poa*', *in* N.G. Walsh & T.J. Entwistle (eds), *Flora of Victoria* volume 2, Melbourne: Inkata Press.

Muelleria 22: 19–76 (2005)

Taxonomic studies in the *Grevillea victoriae* F.Muell. species complex (Proteaceae: Grevilleoideae) I. Descriptions of nine previously segregated, and three new taxa.

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Abstract

Nine taxa, including six new taxa erected by us (*G. brevifolia* subsp. *polychroma*, *G. epicroca*, *G. miqueliana* subsp. *moroka*, *G. mouslacana*, *G. parvula*, and *G. victoriae* subsp. *rivalis*) within the *Grevillea victoriae* species complex were recently segregated in Makinson (2000). As well the name *G. victoriae* var. *leptoneura* was there reduced by us to synonymy under *G. parvula*, and *G. brevifolia* was resurrected and raised to species rank. This paper treats the above six named taxa, as well as three new taxa *G. bemboka*, *G. callichlaena*, and *G. miqueliana* subsp. *cincta*. *Grevillea brevifolia* subsp. *polychroma* is here accorded specific rank. A detailed circumscription, accompanied by a citation of representative specimens and notes on the phenology, distribution and conservation status, habitat and ecology, etymology and distinguishing characters are included for each taxon.

Introduction

Although previous workers (Olde & Molyneux 1994; Makinson 1997; Makinson 2000, Molyneux & Stajsic in Makinson 2000) had taxonomically recognised some of the diversity present in the *Grevillea victoriae* species complex, unresolved elements of the complex nevertheless remained, and some rankings were regarded as tentative. It was deemed that additional morphological characters (including seldom used characters) and extensive field studies of all the taxa would provide useful data to assist the elucidation of the 'races' and the 'unassigned specimens' sensu McGillivray & Makinson (1993). During fieldwork a number of taxa unrepresented by herbarium specimens at the time of McGillivray & Makinson's revisionary work were discovered or collected for the first time. Three of these taxa are described in this paper: *Grevillea bemboka*, *G. callichlaena* and *G. miqueliana* subsp. *cincta*. *G. brevifolia* subsp. *polychroma* is raised to species rank as *G. polychroma*.

The *Grevillea victoriae* species complex is here taken as being equivalent to the *Victoriae* Subgroup (one of five subgroups) within the *Linearifolia* Group sensu Makinson (2000). Makinson (2000) included fourteen named taxa within the *Victoriae* subgroup. In light of this paper seventeen named taxa are considered to be members of the subgroup. Many of the taxa in the *Victoriae* Subgroup have a rather narrow, straight erect perianth with the limb abruptly nodding or deflexed. In these taxa the style in late bud stage is always weakly exserted to the lower rear of the perianth rather than arching above the perianth curve as in the closely related *Speciosa* Subgroup (Makinson 2000).

The *Grevillea victoriae* species complex consists of a number of taxa commonly associated with montane to alpine habitats in Victoria, southeastern New South Wales, Queensland and the Australian Capital Territory. However most though occur in montane or high montane rather than alpine regions. *Grevillea parvula* is the only member of the complex found near sea level, for example on the banks of the lower Wallagaraugh River above Gipsy Point eastern Victoria. Because of the high level of morphological heterogeneity observed between many populations within this polymorphic assemblage,

the *G. victoriae* species complex has been regarded as one of the more intractable complexes still awaiting resolution within the genus.

Grevillea victoriae F.Muell. was described by Mueller in September 1855. Mueller based his description of *G. victoriae* on several collections made in the Victorian Alps (Mounts Buffalo, Buller, Tambo, Hotham and La Trobe and sources of the Mitta Mitta are cited by him). In the same month he described *G. miqueliana* from collections made at montane sites in central Gippsland (near Mt McMillan and on the Upper Avon River) (McGillivray & Makinson 1993; Makinson 1997). *Grevillea victoriae sens. lat.* has traditionally been characterised by having a smooth leaf upper surface and a silky ± appressed indumentum on the branchlets, floral rachises, leaf undersurface, and perianth. *Grevillea miqueliana*, on the other hand, has been characterised by having an granulose leaf upper surface, and an indumentum of spreading hairs on the branchlets, floral rachises, leaf undersurface and perianth (Willis 1973; McGillivray & Makinson 1993; Makinson 1997).

Bentham (1870) described the material from Mt Tambo as a distinct species and named it *Grevillea brevifolia* F.Muell. ex Benth., which Maiden and Betche (1916) reduced to *G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) F.Muell. ex Maiden & Betche. Bentham (1870) also named *G. victoriae* F.Muell. var. *leptoneura* Benth. based on collections from the source of the Genoa River, near the Victorian border with New South Wales.

Johnson (1962) moved the species complex a step closer toward a taxonomic resolution with the description of *G. diminuta*. McGillivray (1986) took a further step when he published the name *G. linsmithii* based on collections from southeastern Queensland and northern New South Wales.

Makinson (1991) in his account of *Grevillea* for the *Flora of New South Wales* recognised a broad concept of *G. victoriae* that incorporated *G. miqueliana* as a synonym, commenting that the traditionally used characters to separate *G. miqueliana* and *G. victoriae* do not provide an adequate definition of groups within the complex. He pointed out that a number of forms could be identified differing in leaf and floral morphology, flower colour, habit and ecological preferences.

McGillivray & Makinson in their (1993) revision of the genus delineated eleven informal races within a broadly circumscribed *G. victoriae*; three of these informal races being part of the *G. miqueliana* group which they relegated to synonymy under *G. victoriae*, the latter name taking priority (Aston 1984; McGillivray & Makinson 1993). Aston (1984, p. 283) indicates that both names were probably published in September 1855 and that the *Trans. Philos. Soc. Victoria* in which the name *Grevillea victoriae* appears, probably preceded the *Trans. & Proc. Victorian Inst.* in which *G. miqueliana* was published. The eleven races of McGillivray & Makinson (1993) were delineated on the basis of eight leaf characters (leaf shape, texture, length, width, indumentum on the upper and lower surface, reticulum on the upper and lower surface) and three floral characters (external perianth indumentum, shape of limb and the thickness of the ultimate peduncles). McGillivray & Makinson commented on the variation in floral density, flower number and the shape and size of the perianth below the limb, but these were not assessed quantitatively. In addition, McGillivray & Makinson designated a further eight poorly collected entities which were unassignable to any of their eleven informal races.

Olde & Molyneux (1994) delimited a further two new species, *G. hockingsii* from southeastern Queensland and *G. mollis* from the Northern Tablelands of New South Wales. They commented that McGillivray & Makinson (1993) had submerged much diversity in a broadly circumscribed *G. victoriae*. The paper by Olde and Molyneux was significant in that it illustrated the importance of using diagnostic characters such as the number of flowers per raceme, perianth length, external perianth indumentum density, internal perianth beard length, limb shape, style length, style end angle, pollen-presenter angle, pollen-presenter shape and follicle size. While McGillivray & Makinson (1993) employed these characters in their monograph generally, they did not use them when

characterising the races within the *G. victoriae* species complex. Like Olde and Molyneux (1994), Hart and Henwood (1996) also found most of these characters to be valuable in their reassessment of the *G. buxifolia* species complex.

Olde and Marriott (1995) reinstated *G. miqueliana* in a broad sense as a distinct species. However, Makinson (1996) retained McGillivray & Makinson's informal scheme for the Victorian taxa, with *G. miqueliana* placed in synonymy under *G. victoriae*, pending clarification of the variation in this group.

Makinson (1997) delineated a further two species each with two subspecies. *Grevillea oxyantha* subsp. *oxyantha* (race 'a' of McGillivray & Makinson) occurs in the Australian Capital Territory and the southern tableland areas of New South Wales from near Pipers Lookout on the Snowy Mountains Highway, to Booromba Rocks in Namadgi National Park in the north. *Grevillea oxyantha* subsp. *ecarinata* (race 'b' of McGillivray & Makinson) occurs in New South Wales from Miealong Creek area near Wee Jasper south to near Tumut and Bago State Forest near Batlow. *Grevillea rhyolitica* subsp. *rhyolitica* ('unassigned specimen 7' of McGillivray & Makinson) and *G. rhyolitica* subsp. *semivestita* (race 'g' of MacGillivray and Makinson) are both endemic to Deua National Park in the South Coast and Southern Tablelands regions of New South Wales.

To facilitate resolution of the complex, eight new taxa were named in Makinson (2000). Two of these taxa, *G. irrasa* Makinson subsp. *irrasa* (race 'l' of McGillivray & Makinson) and *G. irrasa* subsp. *didymochiton* were named by Makinson, the other six being named by the authors of this paper. These six taxa include: *G. brevifolia* F.Muell. ex Benth. subsp. *polychroma* Molyneux & Stajsic (Race 'f' *pro parte* of McGillivray & Makinson), *G. epicroca* Stajsic & Molyneux ('unassigned specimen 5' of McGillivray & Makinson), *G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsic (Race 'k' of McGillivray & Makinson), *G. monstacana* Molyneux & Stajsic (Race 'h' of McGillivray & Makinson), *G. parvula* Molyneux & Stajsic (Race 'f' *pro parte* of McGillivray & Makinson) and *G. victoriae* F.Muell. subsp. *nivalis* Stajsic & Molyneux (Race 'd' of McGillivray & Makinson). The present paper still only partially resolves the heterogeneity evident within the *G. victoriae* species complex. This will be the subject of ongoing studies, in particular the *G. oxyantha* species subcomplex (which is part of the *G. victoriae* species complex).

For a summary of the nomenclatural history of *G. brevifolia*, *G. miqueliana*, *G. parvula*, and *G. victoriae* see Table 1. A summary of McGillivray & Makinson's (1993) 'races' and 'unassigned specimens' and their current names/taxonomic placement is given in Table 4.

Materials and Methods

Five hundred and twenty-five specimens from MEL and NSW herbaria were examined and measured, including spirit material held at MEL collected during fieldwork by one of us (Stajsic). Herbarium specimens were augmented with material collected in the field between 1996-2003. Where possible at least five plants per site were sampled. A total of 3-5 flowers and 10 leaves per herbarium specimen were measured. Measurements of floral characters are based both on rehydrated herbarium specimens and live material collected by the authors. Spirit-preserved specimens were not employed for morphometric measurements as they become inflated due to absorption of liquid, although they were used for qualitative data such as the shape of the pollen-presenter in cross-section. Supplementary observations and measurements were made from the cultivated collections propagated in the private garden of one of us (Molyneux), and the living collections held at the Royal Botanic Gardens Melbourne. Distribution maps were generated using ArcView computer program. Descriptive terminology follows McGillivray & Makinson (1993) and Makinson (2000), except as indicated below. Conservation codes are assigned according to both ROTAP (Briggs & Leigh 1996) and IUCN (2001) systems.

Table 1. A nomenclatural history of *G. brevifolia*, *G. miqueliana*, *G. parvula* and *G. victoriae*.

Stajsic & Molyneux (2005)	**Makinson (2000), Molyneux & Stajsic in Makinson (2000)**	**Makinson (1996)**	**Olde & Marriott (1995)**	**McGillivray & Makinson (1993)**
G. brevifolia F.Muell. ex Benth.	*G. brevifolia* F.Muell. ex Benth. subsp. *brevifolia*	*G. victoriae* F.Muell. 'race e' sensu McGillivray & Makinson (1993)	*G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) F.Muell. ex Maiden & Betche	*G. victoriae* F.Muell. 'race e'
G. miqueliana F.Muell. subsp. *miqueliana*	*G. miqueliana* F.Muell. subsp. *miqueliana*	*G. victoriae* F.Muell. 'race j' sensu McGillivray & Makinson (1993)	*G. miqueliana* F.Muell.	'Typical form' *G. victoriae* F.Muell. 'race j'
G. miqueliana F.Muell. subsp. *cincta* (2005)	Not known at the time	Not known at the time	Not known at the time	Not known at the time
G. miqueliana F.Muell. subsp. *moroka* Molyneux & Stajsic in Makinson (2000)	*G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsic in Makinson (2000)	*G. victoriae* F.Muell. 'race k' sensu McGillivray & Makinson (1993)	*G. miqueliana* F.Muell. 'Mt Wellington form'	*G. victoriae* F.Muell. 'race k'
G. parvula Molyneux & Stajsic in Makinson (2000)	*G. parvula* Molyneux & Stajsic in Makinson (2000)	*G. victoriae* F.Muell. 'race f' *pro.parte*. sensu McGillivray & Makinson (1993)	*G. victoriae* F.Muell. var. *leptoneura* Benth. (1870)	*G. victoriae* F.Muell. 'race f' *pro.parte.*
G. polychroma (Molyneux & Stajsic) Molyneux & Stajsic comb. et stat. nov. (2005)	*G. brevifolia* F.Muell. ex Benth. subsp. *polychroma* Molyneux & Stajsic in Makinson (2000)	*G. victoriae* 'race f' *pro.part*. sensu McGillivray & Makinson (1993)	G. victoriae F.Muell. var. *leptoneura*	*G. victoriae* F.Muell. 'race f' *pro.parte.*
G. victoriae F.Muell. subsp. *victoriae*	*G. victoriae* F.Muell. subsp. *victoriae*	*G. victoriae* F.Muell. 'race e' sensu McGillivray & Makinson (1993) (= *G. victoriae* F.Muell. var. *victoriae pro. parte.* sensu Olde & Marriott (1995))	*G. victoriae* F.Muell. var. *victoriae pro. parte.*	*G. victoriae* F.Muell. 'race e'
G. victoriae F.Muell. subsp. *univalis* Stajsic & Molyneux (2000)	*G. victoriae* F.Muell. subsp. *univalis* Stajsic & Molyneux (2000)	Unknown in Victoria at the time	*G. victoriae* F.Muell. var. *victoriae pro. parte.*	*G. victoriae* F.Muell. 'race d'

Makinson (1991)	**Maiden & Betche (1916)**	**Bentham (1870)**	**Mueller (1855)**
First report for NSW in Stajsic & Molyneux (2005)	*G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) F.Muell. ex Maiden (applieation unclear)	*G. brevifolia* F.Muell. ex Benth. (1870)	*G. victoriae* F.Muell. (1855)
Does not occur in NSW	*G. miqueliana* F.Muell. (application unelear) *G. m.* subsp. *miqueliana* does not occur in NSW	*G. miqueliana* F.Muell.	*G. miqueliana* F.Muell. (1855)
Does not oeeur in NSW	Not known at the time & does not oeeur in NSW	Not known at the time	Not known at the time
Does not occur in NSW	Not known at the time & does not oeeur in NSW	No specimens attributable to *G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsic cited	No specimens attributable to *G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsic cited
G. victoriae F.Muell.	? under *G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) Maiden & Betche	*G. victoriae* F.Muell. var. *leptoneura* Benth. (1870)	No specimens attributable to *G. parvula* cited in protologue
Does not occur in NSW	Not known at the time & does not occur in NSW	Not known at the time	Not known at the time
G. victoriae F.Muell. sens. lat.	Does not occur in NSW	*G. victoriae* F.Muell. var. *victoriae*	*G. victoriae* F.Muell.
G. victoriae F.Muell. sens. lat.	? under *G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) Maiden & Betche	NSW specimens not cited	No speeimens referable to *G. victoriae* subsp. *uivalis* Stajsic & Molyneuex cited in protologue of *G. victoriae*

Terminology for descriptions and keys

- **Colour of new growth** here refers to the very early current season new growth of leaves. Very young branchlets can also often be the same colour as the very young leaves.
- **Very early flower buds** refers to the very young buds, with neither the limb or the perianth below the limb fully developed. It refers to the stage after the caducous floral bracts have fallen away, but it does not refer to the advanced flower buds just prior to tepal separation.
- **Advanced flower buds** refers to the buds with a fully developed limb and perianth below the limb just prior to tepal separation stage.
- **Acropetal** as used here is equivalent to centripetal as used by McGillivray & Makinson (1993). We follow Makinson (2000) in using the term acropetal to describe a unit conflorescence in which the basal flowers open first and then higher flowers in ascending order.
- **Bichromatic** is here defined as dorsal tepals pinkish-red in the inner half of tepal length, i.e adjacent to where the lateral margins of the dorsal tepals meet each other, yellow in the outer half of tepal length i.e. adjacent to where the lateral margins of the dorsal tepals meet the ventral tepals, ventral tepals wholly yellow on inner surface.

Indumentum terminology

- **Subtomentose** = bearing a dense, often untidy indumentum of both appressed and ascending hairs in ± equal proportion (the term is here defined for clarification. Makinson (2000: 258) did use the term but it did not appear in the glossary.)
- **Branchlet angularity** is usually only detectable and persistent on current-year or previous year growth.
- **Leaf characters** are based on mature leaves sampled from midpoint of a branchlet. Note that taxa with glabrous leaf upper surfaces in the mature stage are often hairy when immature.
- **Conflorescence branching** is based upon averages obtained from all the measured specimens for each taxon, and does not necessarily reflect the percentages found in any one specimen.
- **Overall colour of the primary peduncle** and floral rachis depends on the density of the indumentum, the colour of the hairs and to what degree the epidermis is exposed. In species descriptions where the overall colour of the primary peduncle in described as being greenish-white, the greenish colour is attributable to the epidermis showing through the sparse indumentum, and not the colour of the hairs.
- **Perianth outer surface colour** is also largely influenced by the colour of the epidermis if the perianth indumentum is sparse.
- **Angle of the pollen-presenter** in relation to the style and the cross-sectional shape of the pollen-presenter usually require fresh or spirit-preserved material as it cannot usually be reliably determined from dry specimens.

Taxonomy

The arrangement of taxa in this paper is alphabetical and does not reflect phylogeny.

Key to Species

1. Leaf upper surface distinctly finely to granulose; branchlets subvillous; leaf lower surface loosely subvillous to villous.....2

1a. Leaf upper surface smooth (occasionally microscopically asperulous (40x magnification) in *G. niqueliana* subsp. *niqueliana* and *G. victoriae* subsp. *nivalis*), smooth to touch, never granulose), glabrous or variably pubescent; branchlets variably pubescent; leaf lower surface variably pubescent. 6

2. Leaves oblong to obovate or narrowly so, or occasionally elliptic, leaf l:w ratio 5-10:1, lateral veins on leaf lower surface usually not evident; pistil 14–17 mm long. 3

2a. Leaves ovate to narrowly-elliptical, elliptical or broadly so, ovate, obovate to occasionally broad-obovate or slightly obovate, leaf l:w ratio 1.5–4:1, lateral veins on leaf lower surface evident to prominent; pistil 18–24 mm long.....4

3. Leaves narrowly oblong or narrowly obovate, leaf l:w ratio 5:1–10:1; leaf lower surface with all hairs ± erect or suberect, not obviously two-layered. ....***G. irrasa*** subsp. ***irrasa***

3a. Leaves obovate to narrowly so or elliptic or oblong, leaf l:w ratio 5:1–7:1; leaf lower surface with erect or suberect hairs emergent from a denser layer of appressed hairs. .....***G. irrasa*** subsp. ***didymochiton***

4. Leaf upper surface consistently granulose; flower buds at all developmental stages wholly reddish-ferruginous; perianth outer surface below the limb densely subvillous, epidermis usually not visible or occasionally partially visible; tepal inner surface uniformly pinkish-red.....***G. callichlaena***

4a. Leaf upper surface smooth, microscopically asperulous (40x magnification), or granulose; flower buds at all developmental stages never reddish-ferruginous; perianth outer surface below the limb usually loosely subvillous, epidermis visible; tepal inner surface usually bichromatic. 5

5. Leaves ovate to elliptical or occasionally obovate (occasionally narrowly so), (22–) 30–85 mm x 15–33 mm; leaf margins rolled downwards to shortly recurved; conflorescences simple or once-branched; floral rachis 22–36 (–42) mm long ....***G. uniqueliana*** subsp. ***uniqueliana***

5a. Leaves elliptical to occasionally ovate, (9–) 20–35 (–50) mm x (5–) 8–16 (–25) mm; leaf margins distinctly revolute; dull; conflorescences mostly simple; floral rachis (5–) 2–20 (–25) mm long. .....***G. uniqueliana*** subsp. ***uoroka***

6. Perianth (below the limb) wholly green or green in lower half and red in the upper half (as is the limb) in both the outer and inner surfaces. 7

6a. Perianth (below the limb) usually pink or pinkish-red (seldom cream, yellow or orange, but never green or half-green).....8

7. Perianth pale-green; stigma prominent, 0.6–0.8 mm long. .....***G. cyranostigma***

7a. Perianth mid-green in the lower half, orange-pink to bright-red in the upper half (limb included); stigma < 0.5 mm long. .....***G. linsmithii***

8. Leaf upper surface with a tangible velvety indumentum.....***G. mollis***

8a. Leaf upper surface glabrous or with sparse appressed hairs, the hairs rarely ascending, never velvety.....9

9. Floral rachis and perianth outer surface below the limb all with both biramous non-glandular hairs and simple, erect glandular hairs (the latter sometimes few and inconspicuous). .....***G. rhyolitica*** subsp. ***rhyolitica***

9a. Floral rachis and perianth outer surface below the limb with biramous non-glandular hairs only (seldom the base of perianth outer surface with occasional microscopic erect glandular hairs in *G. epicroca* and *G. parvula*). 10

10. Conflorescence predominantly axillary or cauline, rarely terminal, unit conflorescence 2–10 flowered; floral rachis 2–8 mm long. .....***G. hookingsii***

10a. Conflorescence usually terminal, or terminal and axillary, never predominantly axillary or seldom cauline, unit conflorescence with > 10 flowered; floral rachis (5–) 10–50 mm long. 11

11. Branchlets densely subvillous, densely tomentose or subtomentose; leaf lower surface indumentum various; pollen-presenter lateral or oblique to style, flat, convex or concave in cross- section.....12

11a. Branchlets densely to sericeous or subsericeous; leaf lower surface indumentum usually sericeous; pollen-presenter oblique to style, flat or slightly convex in cross-section. 18

12. Pollen-presenter lateral to style end; face of pollen-presenter usually strongly concave (rarely flattened) in cross-section, base concurrent with the style. ..13

12a. Pollen-presenter strongly oblique to style-end; face of pollen-presenter convex in cross-section, base not concurrent with the style.....14

13. Branchlets usually tomentose or occasionally subvillous, young branchlets usually apricot-coloured; colour of new growth ferruginous, leaf upper surface consistently glossy; colour of very early flower buds wholly apricot-coloured; perianth-limb obtuse or subacute, slightly to moderately keeled. .....***G. bemboka***

13a. Branchlets consistently densely subvillous, young branchlets usually purplish-pink or pink; colour of new growth purplish-pink or pink (seldom green); leaf upper surface usually dull (seldom glossy); colour of very early flower buds wholly reddish-purple perianth-limb not keeled (seldom obscurely keeled). .....***G. parvula***

14. Leaf lower surface densely subsericeous or occasionally densely subtomentose (epidermis not visible); the inner surface of the recurved portion of the perianth below the limb in open flower usually monochromatic. ....***G. victoriae*** subsp. ***nivalis***

14a. Leaf lower surface loosely sericeous or with scattered mutually aligned appressed hairs (epidermis usually clearly visible), or loosely to moderately subtomentose (epidermis visible), or loosely subvillous (epidermis visible); the inner surface of the recurved portion of the perianth below the limb in an open flower usually monochromatic or bichromatic. 15

15. Leaf l:w ratio (3.6:1–) 4.0– 6.0:1 (-8.0:1); floral bracts 1.0–1.5 (–2) mm long; the inner surface of the recurved portion of the perianth below the limb of an open flower monochromatic, the outer surface of ventral tepals uniformly coloured, without a central blotch. .....***G. monslacana***

15a. Leaf l:w ratio 1.5–4.0:1; floral bracts 2.0– 4.2 mm long; the inner surface of the recurved portion of the perianth below the limb in an open flower usually bichromatic, outer surface usually with a central blotch and usually red or pinkish-red towards base and apex of the perianth. 16

16. Branchlets densely subtomentose or subvillous; leaf lower surface subsericeous with predominantly mutually aligned, appressed hairs with scattered ascending hairs, or occasionally subtomentose with a lower layer of predominantly mutually aligned, appressed hairs with an overlayer of scattered ascending and suberect hairs or slightly ascending hairs.....***G. uniqueliana*** subsp. ***ciucta***

16a. Branchlets densely subvillous; leaf lower surface villous, the hairs erect or suberect hairs. 17

17. Leaves ovate to elliptical or occasionally obovate (occasionally narrowly so), (22–) 30–85 mm x 15–33 mm; leaf margins rolled downwards to shortly recurved; confloresecences typically simple or once-branched; floral rachis 22–36 (–42) mm long.....***G. uniqueliana*** subsp. ***uniqueliana***

17a. Leaves elliptical to occasionally ovate, (9–) 20–35 (–50) mm x (5–) 8–16 (-25) mm; leaf margins distinctly revolute; confloresecences typically simple; floral rachis (5–) 12–20 (–25) mm long. ..... ***G. uniqueliana*** subsp. ***uoroka***

18. Peduncle, floral rachis, pedicel and perianth outer surface with both biramous non-glandular hairs and simple erect minute glandular hairs. ....***G. rhyolitica*** subsp. ***semivestita***

18a. Peduncle, floral rachis, pedicel and perianth outer surface with biramous non-glandular hairs only (seldom with microscopic simple erect hairs at base of perianth in *G. epicroca* and *G. parvula*). 19

19. Pistil 10–11 mm long. .....*G. diminuta*

19a. Pistil (16–) 18–25 mm long. 20

20. Very early flower buds with a purplish-pink, lilac or pale-pink perianth below the limb, limb pale-brown or dirty greyish-brown; the inner surface of the recurved portion of the perianth below the limb in an open flower usually biehromatic. .....***G. uniqueliana*** **subsp.** ***cincta***

20a. Very early flower buds wholly ferruginous or perianth below the limb occasionally reddish or limb occasionally tan-coloured; the inner surface of the recurved portion of the perianth below the limb in an open flower monochromatic, the outer surface of ventral tepals uniformly coloured, without a central blotch. 21

21. Pollen-presenter lateral to style; face of pollen-presenter strongly concave in cross-section (seldom lower margins incurved giving appearance of being slightly concave in cross-section as in some plants of the Mt Elizabeth population of *G. polychroma).* 22

21a. Pollen-presenter oblique to style; face of pollen-presenter flat or convex in cross-section. 24

22. Branchlets strongly angular in cross-section (tending to become subangular or subterete away from branchlet apices), loosely sericeous or with scattered mutually aligned, appressed, silvery-white hairs; leaf lower surface loosely sericeous or with scattered mutually aligned, appressed hairs, epidermis clearly visible. .....***G. epicroca***

22a. Branchlets terete, subterete, biconvex (or seldom subangular in *G. polychroma*), densely sericeous or subsericeous, epidermis not visible; leaf lower surface densely sericeous or subsericeous, epidermis not visible. 23

23. Branchlets densely tomentose or subvillous; leaf lower surface subsericeous to subtomentose, lateral veins evident to conspicuous; perianth-limb obtuse or subacute, slightly to moderately midline-keeled, face of pollen-presenter concave in cross-section, perianth below the limb red or pinkish-red. .....***G. benthoka***

23a. Branchlets densely subsericeous or occasionally subtomentose; leaf lower surface sericeous or subsericeous, lateral veins obscure to evident; perianth-limb obtuse and not keeled; face of pollen-presenter flat (seldom lower margins incurved giving appearance of being slightly concave in cross-section as in some plants of the Mt Elizabeth population of *G. polychroma)*; perianth below the limb creamish, pale-yellow, pink, pinkish-red or red. .....***G. polychroma***

24. Perianth-limb acute to strongly acute. 25

24a. Perianth-limb obtuse (or if seldom subacute as in the Merryangaah Peak population of *G. brevifolia* then leaves < 50 mm long and < 20 mm wide)...26

25. Perianth-limb strongly midline-keeled on outer surface; leaf lower surface densely tomentose to subtomentose (rarely almost subsericeous) with short tightly curled to wavy hairs; floral rachises 8–13 mm long. .....***G. oxyantha*** subsp. ***oxyantha***

25a. Perianth-limb slightly to moderately midline-keeled on outer surface; leaf lower surface densely subsericeous to subtomentose with mutually aligned appressed and slightly ascending straight hairs; floral rachises (12–) 20–45 mm long. ....***G. oxyantha*** subsp. ***ecarinata***

26. Leaves (8–) 21–38 (–49) mm x 6–16 (–20) mm wide; leaf l:w ratio 2:1; floral rachis (7–) 15–20 (–35) mm long; unit conflorescence with (14–) 20–22 (–30) flowers. .....***G. brevifolia***

26a. Leaves (20–) 35–120 (–200) mm x (7–) 10–35 (–50) mm wide, leaf l:w ratio 2:1– 5:1 (–6:1); floral rachis (8–) 17–66 (–87) mm long; unit conflorescence with (16–) 22–48 (– 68) flowers. 27

27. Leaves usually narrowly elliptical to lanceolate (rarely oblanceolate), (30–) 40–120 mm long, (8–) 10–25 (–50) mm wide, l:w ratio (3:1–) 4:1–5:1 (–6:1); leaf margins shortly recurved; leaf upper surface not microscopically asperulous, usually dull; leaf lower surface usually densely sericeous or occasionally subsericeous, usually 'tidy' with mutually-aligned, appressed hairs (only with the occasional ascending or suberect ferruginous hairs; leaf lower surface reticulum absent or obscure; floral rachises (17–) 40–90 mm long. .....***G. victoriae*** subsp. ***victoriae***

27a. Leaves usually elliptic to narrowly-elliptical or rarely ovate, (20–) 35–100 (–135) mm long, (7–) 15–37 mm wide, l:w ratio 2.25:1–4:1 (–5:1); leaf margins flat or very shortly recurved (occasionally rolled or revolute); leaf upper surface glabrous/smooth or occasionally microscopically asperulous (smooth to touch), semi-glossy; leaf lower surface very densely subsericeous, or subtomentose, slightly 'messy'; leaf lower surface reticulum usually conspicuous or prominent; floral rachises (8–) 10–50 (–60) mm long. .....***G. victoriae*** subsp. ***nivalis***

Grevillea bemboka Stajsic & Molyneux, *sp. nov.*

A *G. parvula* Stajsic & Molyneux ramulis plerumque tomentosis (interdum subvillosis), ramulis junioribus saepe armeniacis, sureulis novis ferrugineis (raro viridibus), lamina supra nitenti, alibastris junioribus omnino armeniacis, limbo perianthii obtuso vel subacuto, segmentis limbi extra leviter vel moderate costatis differt.

Type: New South Wales, South Coast, Bemboka State Forest, 2.6 km at 80 degrees from Bemboka Peak, 26 March 1992, *I.R. Telford 11565 & I. Crawford* (holo: MEL 1617093!; iso: AD *n.v.*, CANB *n.v.*, BRI *n.v.*, NSW!, BISH *n.v.*).

Spreading to erect *shrub* to 4 m high, to 7 m across, plants from mesic sites more open and straggly than those from more exposed cliff-top sites. *Branchlets* terete to subterete or biconvex in cross-section, with several longitudinal ridges; densely tomentose or occasionally densely subvillous, of biramous non-glandular hairs, epidermis not visible, with a lower layer of predominantly mutually aligned, ascending and appressed, predominantly straight hairs with scattered ± slightly wavy hairs, off-white and tan-coloured, with scattered ferruginous hairs, with an overlayer of predominantly irregularly aligned, ascending, suberect and erect, predominantly straight hairs with scattered ± slightly wavy, off-white, tan-coloured and ferruginous hairs. *Colour of new growth* ferruginous or apricot-coloured soon becoming green, young branchlets often remaining pale apricot-coloured. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, ovate to elliptical to occasionally obovate, (17–) 35–60 (–85) mm long, (8.5–) 10–20 (–25) mm wide, apex usually acute with a short blunt mucro or obtuse, *margins* rolled; leaf length to width ratio (2.35:1–) 3.0:1–5.0:1; *leaf upper surface* minutely foveolate, glabrous except for mutually aligned, appressed, biramous non-glandular, silvery-white hairs just above petiole, with occasional irregularly aligned tan-coloured or ferruginous overlying hairs, distinctly glossy, mid-green; *lateral veins* obscure to occasionally evident, *reticulum* absent; *leaf lower surface* densely subsericeous or subtomentose, of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed, straight with occasional ± slightly wavy hairs, and an overlayer of irregularly aligned, ascending, suberect hairs, off-white or silvery-white, with occasional tan-coloured and ferruginous hairs, predominantly appressed, or scattered irregularly aligned, appressed and ascending hairs, *lateral veins*

evident to occasionally conspicuous, *reticulum* absent; thin-textured (mesic sites) to relatively thick leathery-textured (xeric sites). *Conflorescence* terminal or axillary, decurved to pendulous, pedunculate, simple to twice-branched, simple 81%, once-branched 17%, twice-branched 2%; *unit conflorescence* cylindrical or a dome shaped cluster, acropetal; number of flowers 16–28 per unit conflorescence; *primary peduncles* (0–) 5–20 (–40) mm long, 1.0–1.4 mm wide, indumentum (as in rachises) moderately densely subsericeous or tomentose of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, straight with occasional ± slightly wavy hairs, appressed, off-white or silvery-white, with scattered irregularly aligned, appressed, straight or occasionally ± slightly wavy hairs, ascending and occasionally suberect tan-coloured and ferruginous hairs, overall colour (as in rachises) whitish or greenish-white; *floral rachises* 10–31 mm long; *floral bracts* narrowly-triangular, creseentic in side-view, basally truncate, apex acute but blunt-tipped, 1.0–1.2 mm long, 0.2–0.3 mm wide, outer surface densely subsericeous or subtomentose of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, predominantly straight, appressed, tan-coloured or ferruginous, with scattered slightly ascending hairs, the inner surface glabrous except in the upper 1/3-1/4, greenish-white, bracts persistent until buds 1.2 mm long; *pedicels* 3–5.5 mm long; *torus* oblique at 20–30°, squarish in plane-view with rounded angles; *very early flower buds* wholly apricot-coloured, perianth below the limb maturing to red or reddish-pink, limb maturing to apricot-coloured, brownish-grey or light-ferruginous; *advanced buds* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* squarish with rounded angles in cross-section; *perianth outer surface below the limb* moderately densely subsericeous or subtomentose, of biramous non-glandular hairs, epidermis visible, the hairs predominantly mutually aligned, straight with scattered ± slightly wavy hairs, appressed with scattered, slightly ascending hairs, predominantly tan-coloured and ferruginous with scattered off-white or silvery-white hairs, epidermis red or reddish-pink, overall perianth colour red; *perianth inner surface epidermis below the limb* minutely papillate below beard, glabrous except for beard, red or reddish-pink; *perianth-limb* subglobose in side-view, squarish face-on, obtuse or subacute, limb-segments slightly to moderately midline-keeled on outer surface, densely subsericeous or subtomentose, of biramous non-glandular hairs, epidermis not visible the hairs predominantly mutually aligned, appressed, straight with occasional ± slightly wavy hairs, predominantly tan-coloured and ferruginous, with or without off-white and dark reddish-ferruginous, scattered slightly ascending hairs, epidermis red or reddish-pink; *dorsal tepal beard* commencing 1.5–2.3 mm above toral rim, extending for 5.7–6.5 mm, hairs 1.2–1.3 mm long; *ventral tepal beard* commencing 4.5–6.5 mm above toral rim, extending for 2.2–3.5 mm, hairs 1.2 mm long; *dorsal tepals* 19–21 mm long, 1.7–2.3 mm wide; *nectary* half-annular, projecting 0.3–0.5 mm above toral rim, margins entire, pale-yellow; *pistil* (16.2–) 18–20.5 mm long; *stipe* 1.0–3.0 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth before release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs in the upper 1/4–1/5 of style length, particularly at back of style-end, red or reddish-pink; *pollen-presenter* lateral to style, 2.8–3.2 mm long, 2.3–2.5 mm wide; *face of pollen-presenter* concave in cross-section, base concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, (17–) 20–23 mm long, 5–7 mm deep, wall 0.5–0.7 mm thick, glabrous, faintly colliculose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1e.)

Representative specimens examined: **NEW SOUTH WALES.** South Coast: Bemboka State Forest, Bemboka Peak Fire Trail, ca. 12 km by car from Ryans crossing of the Snowy Mountains Highway, knob at 80° to and 2.75 km ENE from Bemboka Peak, ca. 9.8 km from Bemboka at 50°, 21. viii. 1999, *W.M. Molyneux s.n. & J. Knight* (MEL 2115771, MEL 2115772, Spirit: MEL 2115773, Seedling: MEL 2115775); South East Forests National Park, Bemboka Section, low cliff

at mouth of north-running gully at confluence with Desert Creek, 900 m SW of Mistake Fire Trail ford, 1. vi. 2001, *J. Miles s.n.* (MEL 2121514); South East Forests National Park, Bemboka Section, point of cliff (where it turns from S to E-facing), 1 km SE of Bemboka Peak/Mistake Fire Trails, junction (ca. 9 km NE of town of Bemboka), 24. ix. 2001, *J. Miles s.n.* (MEL 2121516, NSW); South East Forests National Park, Bemboka Section, lower N-facing bank of Desert Creek, ca. 1.1 km NE of junction of Bemboka Peak and Mistake Fire Trails (ca. 9 km NE of Bemboka), 24. ix. 2001, *J. Miles s.n* (AD, CANB, MEL 2116949, NSW; MEL 2116950); South East Forests National Park, Bemboka Section, a bit below cliff base, down steep S-facing soil slope to bank of Desert Creek, ca. 1.1 km SE of Bemboka Peak/Mistake Fire Trail junction, 24. ix. 2001, *J. Miles s.n.* (AD, CANB, MEL 2121517, 2121818, 2121519, 2121520, NSW); South East Forests National Park, Bemboka Section, N of tight bend in Desert Creek ca. 1.5 km SE of junction of Bemboka Peak and Mistake Fire Trails, 3. x. 2001, *J. Miles s.n.* (AD, CANB, NSW; MEL 2123241, 2123242); South East Forests National Park, Bemboka Section, Bemboka Peak Fire Trail, ca. 12 km by car from Ryans crossing of the Snowy Mountains Highway, knob at 80° to and 2.75 km ENE from Bemboka Peak, ca. 9.8 km from Bemboka at 50°, 29. ix. 2002, *V. Stajsic* 3030, *J. Miles, R.G. Coveny & A.E. Orme* (MEL 2240005, 2240006); South East Forests National Park, Bemboka

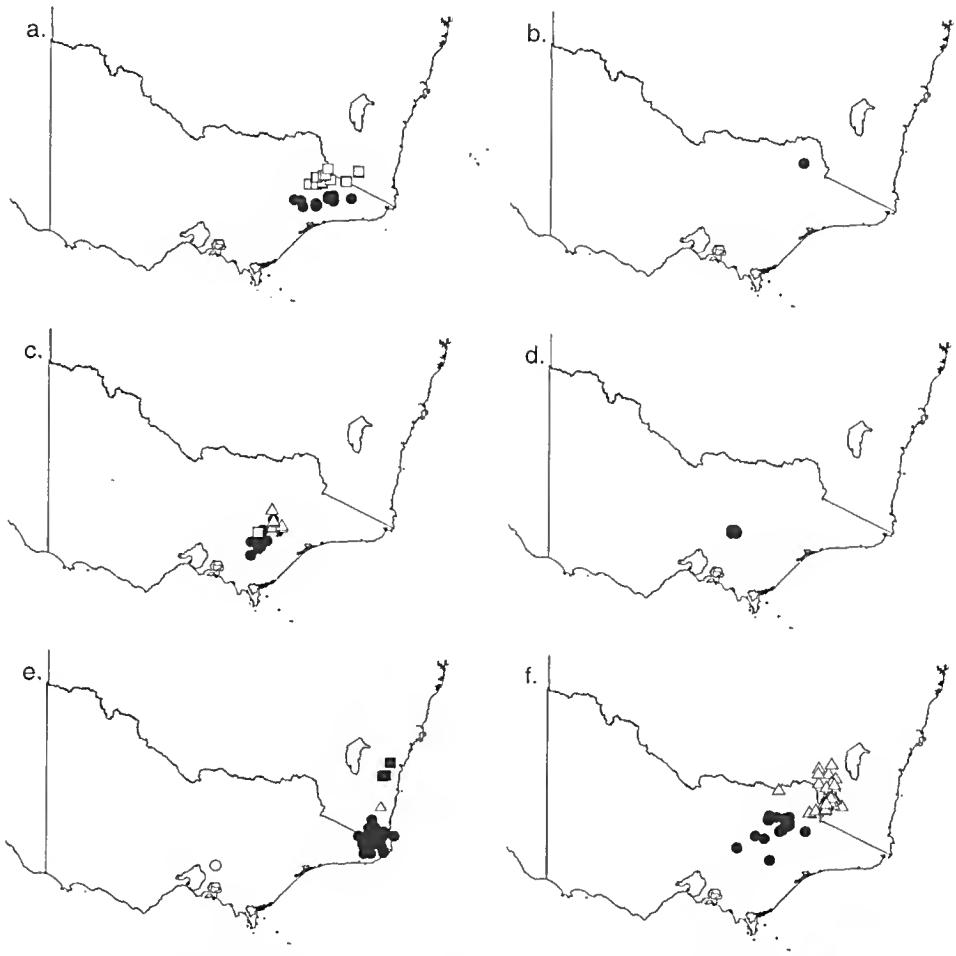

Figure 1. Geographic distribution of a.) *Grevillea brevifolia* (□), *G. polychroma* (●); b.) *G. callichlaena*; c.) *G. miqueliana* (● ssp. *miqueliana*; □ ssp.*cincta*; Δ ssp. *moroka*); d.) *G. monslacana*; e.) *G. parvula* (●; ○ naturalised), *G. bemboka* (Δ), and *G. epicroca* (■); f.) *G. victoriae* (● ssp. *victoriae*; Δ ssp. *nivalis*).

Section, in a north flowing tributary of Desert Creek, ca. 1.5 km SE of junction of Bemboka Peak and Mistake Fire Trails, 29. ix. 2002, *V. Stajsic* 3031-3033, *J. Miles, R.G. Coveny & A.E. Orme* (AD, CANB, MEL 2240007, 2240008, 2240009, NSW); South East Forests National Park, Bemboka Section, ca. 1.1 km NE of junction of Bemboka Peak and Mistake Fire Trails, *V. Stajsic* 3034, *J. Miles, R.G. Coveny & A.E. Orme* (CANB, MEL 2240112, NSW); South East Forests National Park, Bemboka Section, down steep S-facing slope to bank of Desert Creek, ca. 1.1 km SE of Bemboka Peak/Mistake Fire Trail junction, *V. Stajsic* 3040 & *J. Miles* (CANB, MEL 2240114, NSW)

Phenology: Flowering has been recorded between August and March, but can occur sporadically throughout the year. Nectarivorous birds, in particular honeyeaters of various species visit the flowers and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: Grevillea bemboka is endemic to New South Wales, where it is currently known from four to six sites within the Bemboka section of the South East Forests National Park, in the Southern Tablelands of New South Wales, in the vicinity of Desert Creek and the Bemboka Peak Fire Trail. At the type-site there are approximately 30 mature plants, with only occasional seedlings seen (Stajsic pers. observ. 2002). The largest population (steep S-facing of Desert Creek, ca. 1.1 km SE of Bemboka Peak/Mistake Fire Trail junction) consisting of between 100–200 plants. The total known number of mature plants between the known (and vouchered) sites is within the range of 150–250. However, it is appears to be scattered along Desert Creek, from near the type-site to where Desert Creek enters cleared land, a distance of approximately 7 km in a straight-line (J. Miles pers. comm. 2001). A conservation status of Endangered (2ECi *sensu* Briggs & Leigh 1996) or Endangered (EN *sensu* IUCN 2001) is suggested.

Habitat and Ecology: On the Bemboka Peak Fire Trail it grows on a conglomerate knob with *Eucalyptus agglomerata, E. elata, E. sieberi* and *E. spectatrix*. At one exposed cliff-top site above Desert Creek it grows among *Eucalyptus wilcoxii*. At more mesic sites it grows in *Eucalyptus cypellocarpa* and *E. muelleriana* dominated forest, associated with *Angophora floribunda* and *Elaeocarpus reticulatus*.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that a part of one of the populations also occurs along a four-wheel drive track, care must be taken not to eliminate these plants through road works.

Etymology: The epithet is derived from the place name Bemboka and the prominence Mount Bemboka in reference to the occurrence of this species in the Bemboka section of the South East Forests National Park, in the South Coast region of New South Wales. The name Bemboka is a corruption of the Aboriginal nation term '*buubooke*', which means 'moon rising in the sky'.

Notes: Grevillea bemboka is a somewhat difficult species to characterise due to the variability of some morphological characters. We feel that it cannot be accommodated comfortably into any closely related species without destabilising the concept of the other species.

In Makinson (2000) it was commented that the 'Bemboka population' either constituted a distinct taxon allied to *G. parvula* or an intergrade between it and *G. oxyantha*. Subsequent to Makinson (2000), Jackie Miles from Brogo discovered several new populations in the Bemboka section of South East Forests National Park, which have greatly aided the resolution of this entity. Detailed fieldwork and assessment of all the known populations has confirmed the distinctness of this taxon as a species with close affinities with *G. parvula* as well as *G. polyclrona*. Similarity between *G. bemboka* and

G. oxyantha could not be seen except perhaps in the fact that some populations have a subacute, slightly to moderately midline-keeled perianth-limb, although other populations of *G. beuboka* have an obtuse perianth-limb. It is worth noting that other taxa outside the *G. oxyantha* group may also have a subacute perianth-limb such as the Merryangaah Peak (in New South Wales) population of *G. brevifolia* (see also notes for *G. brevifolia*).

G. beuboka differs from *G. parvula* in the colour of the young branchlets which are often apricot-coloured, the new growth being ferruginous not pink or purplish-pink (seldom green) as in *G. parvula*. The branchlet indumentum in *G. beuboka* is usually tomentose but in the type population it is subvillous as in *G. parvula* (occasional specimens from Mt Wog Wog tomentose). The leaf upper surfaces in *G. beuboka* are consistently glossy, whereas in *G. parvula* they are usually dull. The very early flower buds in *G. beuboka* are wholly apricot-coloured, whereas in *G. parvula* they are reddish-purple. The perianth-limb is either obtuse or subacute in *G. beuboka* and the limb segments are slightly to moderately midline-keeled on the outer surface. *Grevillea parvula* has a subglobose perianth-limb and the limb-segments are not midline-keeled. Both *G. beuboka* and *G. parvula* have a lateral pollen-presenter, the face of the pollen-presenter is distinctly concave in cross-section and the base concurrent with the style.

Grevillea beuboka is also similar to *G. polychroma*. The branchlets *in G. polychroma* are usually subsericeous or subtomentose, never subvillous. The leaf lower surface in *G. polychroma* is usually sericeous occasionally subsericeous compared with the usually subsericeous or tomentose indumentum in *G. beuboka*. The lateral veins in *G. polychroma* are either obscure or evident, compared with the usually evident to conspicuous lateral veins in *G. beuboka*. The primary peduncles of *G. polychroma* are 0.8–1 mm wide, compared with 1.0–1.4 mm wide in *G. beuboka*. In *G. polychroma* the perianth-limb is always obtuse and not keeled, the face of the pollen-presenter is flat (seldom lower margins incurved giving appearance of being slightly concave in cross-section as in some plants of the Mt Elizabeth population) and perianth outer surface below the limb is creamish, pale- yellow, pink, pinkish-red or red. In *G. beuboka* the perianth-limb is either obtuse or subacute and slightly to moderately midline-keeled, and the face of the pollen-presenter is usually distinctly concave in cross-section, never flat. The perianth outer surface below the limb in *G. polychroma* varies from red, pink, orange, yellow or cream, sometimes several colour forms are present in the same population.

G. beuboka is also somewhat similar to *G. epicroca* which has strongly angular or subangular branchlets in cross-section, which are sericeous or loosely sericeous or with scattered mutually aligned, appressed, short, silvery-white hairs. The leaf lower surface is also loosely sericeous or with scattered, mutually aligned appressed, short, silvery-white hairs. The new growth in *G. epicroca* is usually salmon-pink not ferruginous as in *G. beuboka*. The perianth-limb is obtuse in side-view never subacute as sometimes in *G. beuboka*.

A number of collections (*Olsen* s.n. NSW 128904; *Crisp* 2389, *D.J. Cummings & A. Tyrrel* NSW 452938; *D.J. Cummings* 41, *M.D. Crisp & A. Tyrrel* NSW 450183; *D.J. Cummings* 42, *M.D. Crisp & A. Tyrrel* NSW 450181) east of Big Badja at the southern extension of the Minuma Range in the Southern Tablelands escarpment of New South Wales appear to be similar to *G. beuboka*. These collections are congruent with the 'unassigned specimen 4' of McGillivray & Makinson (1993). These collections share some points of similarity between *G. beuboka*, *G. parvula* and *G. epicroca*. The specimens have obovate or narrow-obovate leaves, 25-65 mm long x 8-20 mm wide, the leaf upper surface venation is obscure or evident, the leaf lower surface is subsericeous, the perianth-limb obtuse and slightly keeled. The remoteness and difficulty of access to these populations precluded us seeing these populations in the field. Additional collections and fieldwork is required to ascertain the taxonomic status of these populations and their relationship with closely related species. As such, these populations are treated here as unassignable to any of the known taxa in the *G. victoriae* species complex.

Grevillea brevifolia F.Muell. ex Benth., *Fl. Austral.* 5: 423, 467 (1870).

Type: (whole sheet): [Victoria], Mount Tambo at an elevation of 5000 ft., *s.d., Dr ferd. Mueller* (holo: K–Neg.No.Kew 2282!); iso: Mount Tambo 5000', *s.d.*, [*F. Mueller*] (MEL 75156!); iso: Mount Tambo. 5000', *s.d.*, *Dr. ferd. Mueller* (MEL 75157!); probable iso: Mount Tambo 5000', *s.d.*, [*F. Mueller*] (NSW 93318!).

G. victoriae F. Muell. var. *brevifolia* (F. Muell. ex Benth.) F. Muell. ex Maiden & Betche, *Census New South Wales Pl.*: 60 (1916).

G. victoriae F.Muell. 'race e', 'unassigned 3' and 'unassigned 6', of D.J. McGillivray & R.O. Makinson, *Grevillea*:321 (1993).

G. victoriae F.Muell. var. *brevifolia* (F.Muell. ex Benth.) F.Muell. ex Maiden & Betche, of P.M. Olde & N.R. Marriott (1995), *The Grevillea Book* 3: 224.

G. victoriae F.Muell. 'race e', of R.O. Makinson, *Flora of Victoria* 3: 852 (1996).

G. brevifolia F.Muell. ex Benth. subsp. *brevifolia*, of Molyneux & Stajsic in Makinson (2000).

A low dense spreading to erect open *shrub*, 0.5–2.5 m high, 2–3.5 m across. *Branchlets* terete or subterete in cross-section, with several longitudinal ridges, moderately densely subsericeous or subtomentose, of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually-aligned, appressed and slightly ascending, predominantly straight with occasional ± slightly wavy hairs, silvery-white with scattered, irregularly aligned, slightly ascending silvery white hairs and/or with scattered irregularly aligned appressed ferruginous hairs which often overlie the silvery-white hairs. *Colour of new growth* ferruginous, soon becoming green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, elliptical, narrowly-elliptical, ovate or obovate, (8–) 21–38 (–49.5) mm long, 6–16 (–20) mm wide, apex acute or obtuse with a short blunt mucro, *margins* tightly and shortly recurved; *leaf length to width ratio* (1.92:1–) 2.0–2.5:1 (–3.2:1); *leaf upper surface* glabrous or with scattered mutually-aligned, appressed and ascending biramous non-glandular hairs just above petiole, minutely foveolate, glossy, mid-green; *lateral veins* obscure to evident, reticulum absent; *leaf lower surface* densely sericeous or subsericeous, of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight with occasional ± slightly wavy hairs, silvery-white with occasional irregularly aligned appressed and slightly ascending hairs, with or without irregularly aligned appressed ferruginous hairs; *lateral veins* obscure to evident, *reticulum* absent; leathery-textured. *Conflorescences* terminal, less often axillary, decurved, peduneulate, simple to twice branched, simple 77%, once-branched 21%, twice-branched 2%, *unit conflorescence* a shortly conico-cylindrical cluster, acropetal; number of flowers (14–) 20–22 (–30) per unit conflorescence; *primary peduncles* (0–) 3–7 (–11) mm long, (1.0–) 1.2–1.4 (–1.8) mm wide, indumentum (as in rachises) densely sericeous or densely subsericeous, of biramous non-glandular hairs, epidermis visible, the hairs predominantly mutually aligned, appressed, predominantly straight or with occasional ± slightly wavy hairs, silvery-white or off-white, with or without scattered irregularly aligned, ascending and often overlying ferruginous hairs, *overall colour* (as in rachises) off-white or greenish-white; *floral rachises* (7–) 15–20 (–35) mm long; *floral bracts* narrowly-triangular, linear-ereseentie in side-view, basally truncate, apex acute but blunt-tipped, 1.3–1.7 (–2.0) mm long, 0.3–0.5 mm wide, outer surface densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight, predominantly ferruginous with occasional tan-coloured hairs, with scattered irregularly aligned, slightly ascending hairs, inner surface glabrous, brownish-black, bracts persistent until buds 1.5–1.7 mm long; *pedicels* 3-4.7 mm long; *torus* oblique to pedicel at 15–45°, squarish in plane-view with rounded angles; *very early flower buds* wholly ferruginous, perianth below the limb maturing to red, limb maturing to ferruginous; *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth outer surface below the limb* moderately densely

subtomentose or tomentose, of biramous non-glandular hairs, epidermis visible, the hairs predominantly mutually aligned, appressed and slightly ascending or predominantly ascending, straight and ± slightly wavy, ferruginous and tan-coloured, mixed with scattered irregularly aligned and ascending hairs, epidermis red, overall perianth colour red or red-ferruginous; *perianth inner surface epidermis below the limb* minutely papillate below beard, papillae particularly conspicuous along tepal margins where they are often larger and form minute simple hairs, glabrous except for beard, red or reddish-pink; *perianth-limb* subglobose in side-view, squarish with rounded angles face-on, obtuse (or seldom subacute as in plants in the Merryangaah Peak population), limb-segments not keeled or obscurely midline-keeled on outer surface, densely sericeous or subsericeous, of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned with scattered irregularly aligned, appressed or slightly ascending hairs, appressed, predominantly straight with occasional ± slightly wavy hairs, ferruginous to red; *perianth below the limb* squarish with rounded angles in cross-section; *dorsal tepal beard* commencing 1.5–2.3 mm above toral rim, beard extending for 4.5–6 mm, hairs 1.2–1.5 mm long; *ventral tepal beard* commencing 3.2–6 mm above toral rim, beard extending for 2–3.5 mm, hairs 1–1.5 mm long; *dorsal tepals* 17.5–22 mm long, 1.7–2.2 mm wide; *nectary* half-annular, entire or tridentate, projecting 0.3–0.5 mm above toral rim, pale-yellow; *pistil* 18–22 (–24) mm long; *stipe* (1.8–) 2 (–3) mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture prior to release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs predominantly in the upper 1/2 to 1/4 of style (occasionally in the upper 3/4 of style length) length, particularly at back of style-end, red or reddish-pink; *pollen-presenter* oblique to style, 2.5–3.5 mm long, 1.7–2.8 mm wide; *face of pollen-presenter* flat or convex in cross-section, base not concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, 18 mm long, 6–8 mm deep, wall 0.5–0.9 mm thick, glabrous, faintly collieulose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1a.)

Representative specimens examined: **NEW SOUTH WALES.** South Coast: Mearangaah [Merryangaah], viii. 1949, *A.B. Costin s.n.* (NSW 93308); on ridge 0.5 km W of Merriangaah [Merryangaah] Peak, 8. ix. 1981, S.J. *Forbes 606* (MEL 603586). **VICTORIA.** East Gippsland: Mt Tingeringi [Tingaringy], *s.d.*, *W. Bauerlen s.n.* (NSW 93310); Tinkirinki Mountain [Mount Tingaringy], v. 1887, *W. Baeuerlen* [Bauerlen] 529 (MEL); Mt. Tingiringi [Tingaringy], viii. 1949, *A.B. Costin s.n.* (NSW 93311); summit of Tingiringi [Tingaringy], 0.5 ml W of geodetic borderline with N.S.W, 30. xi. 1962, *J.H. Willis s.n. & K.C. Rogers* (MEL 75142); Wombargo Range, 8 mls NNW of Black Mountain Station, Wulgulmerang, 4. xii. 1962, *J.H. Willis s.n.* (MEL 75143); Mount Tingaringy summit, 15. ix. 1979, *N.G. Walsh 295* (MEL 595483); Mount Tingaringy summit, 17. ix. 1979, *H. Van Rees 051* (MEL 559189); Alpine National Park, Mount Tingaringy summit, 22. v. 1993, *A.M. & J. Lyne 1216* (CBG, MEL 713662,). Snowfields: Gorge below Native Dog Flat, Upper Buchan River, 29. i. 1949, *N.A. Wakefield* 2953 (MEL 1510628); Reedy River valley below Brumby Point, Nunniong Plateau region, 13. xi. 1964, *J.H. Willis s.n & K.C. Rogers* (MEL 75141); Buchan River Gorge below Native Dog Plain, 9. i. 1971, *A.C. Beauglehole 35950* (MEL 2146651); Cobberas No. 1, 28. i. 1971, *A.C. Beauglehole 36005 & E.W. Finck* (MEL 2146647); Mount Leinster, S side, 18. ii. 1971, *A.C. Beauglehole 36825* (MEL 2146648); Tambo River, c. 17 mls E of Omeo, Hells Hate [Gate] Hole area, 18. ii. 1973, A.C. *Beauglehole 41546* (MEL 559197, NSW); slopes of Mount Leinster, Benambra region, 10. xii. 1986, *G.E. Earl 531* (MEL 220310); Nunniong Plateau, c. 43 km (direct) just N of E of Omeo, Brumby, Point, c. 200 m straight downslope from terminus of 4WD track, 4. xii. 1991, *R.O. Makinson 941 & P. Caruen* (CBG, MEL 1617065, NE); Bowen Traek, 1 km NE of Splitters Range Track junction E of Omeo, 24. i. 1984, D. *Parkes EG157* (MEL 1543216); Nunniong Plateau, Forlorn Hope Ck, beside the upper part of the cascade, c. 1.5 km S from Forlorn Hope Plain, 2. i. 1985, *N.G. Walsh 1481* (MEL 1540191).

Phenology: Flowering has been recorded from August to May, but in the absence of snow can occur sporadically throughout the year. Nectarivorous birds, in particular honeyeaters of various species visit the flowers and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: Grevillea brevifolia is confined predominantly to the subalpine and alpine regions of Victoria between 1000–1500 m above sea-level. In New South Wales it is known from two sites, at Merryangaah Peak (ca. 25 km NW from Bombala) in the Southern Tablelands of New South Wales at approximately 780 m above sea level, and on the western slopes of The Pilot in Kosciuszko National Park at approximately 1800 m above sea level. The Pilot population was seen by one of us (Molyneux) about twenty years ago, but was not vouchered and is unrepresented in herbaria. The Pilot site is particularly interesting in that it is a site where *G. brevifolia* is sympatric with *G. victoriae* subsp. *uivalis*. Most of the Victorian populations occur within the Alpine National Park, however, the population at the type-site at Mt Tambo is not protected within a reserve system, nor is the Mt Leinster population. The species is not considered to be under any threat in Victoria.

The Merryangaah Peak site in New South Wales is not protected within a reserve system. Although Maiden & Betche (1916) list *Grevillea victoriae* F.Muell. var. *brevifolia* F.Muell. ex Benth. (having reduced it from *G. brevifolia* F.Muell. ex Benth.) in their *A Census of New South Wales Plants* it is unclear as to what taxon they were referring to. Given that the earliest herbarium voucher specimens from Merryangaah Peak are from 1949 and the fact that the species has a very limited distribution in New South Wales, it appears unlikely that the listing in Maiden & Betche (1916) refers to *G. brevifolia*. No other workers since Maiden & Betche have listed *G. brevifolia* as being present in New South Wales. Fieldwork is required at both The Pilot and the Merryangaah sites to determine the number of populations present, the number of individual plants, degree of recruitment and to note any possible threats. A conservation status of Poorly Known (2KC- *sensu* Briggs & Leigh 1996) or Data Deficient (DD *sensu* IUCN 2001) for the New South Wales populations is suggested.

Habitat and Ecology: Grevillea brevifolia is usually found in subalpine and alpine woodlands, typically on rocky sites, slopes, ridges and outcrops. At Mt Tingaringy it grows in soils and rock derived from Ordovician siltstone in an open *Eucalyptus glaucescens* and *E. pauciflora* woodland. At Brumby Point it grows on an almost treeless scree slope derived from Ordovician slates and mudstones, with *Polyscias sambucifolia* and *Podolobium alpestre*, and above Reedy Creek below the gorge. At Mt Leinster it occurs among outcropping granite with sparse tree cover with *Eucalyptus dives, E. mannifera, E. pauciflora, Kunzea ericoides* and *Prostanthera phylicifolia*, while in the Wombargo Range area it occurs among rhyodacite outcrops, as it does in the nearby Cobberas Mountains. At Merryangaah Peak it is found on a rocky ridge in *Eucalyptus glaucescens* woodland with *Acacia glaucescens, A. silvestris* and *Phillotheca tracliyphylla*.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Grevillea brevifolia was described by Bentham (1870) with no infraspecific taxa recognised. Maiden & Betche (1916) reduced *G. brevifolia* to varietal rank under *G. victoriae*. McGillivray & Makinson (1993) relegated *G. brevifolia* into synonymy with *G. victoriae*. Olde & Marriott (1995) treated *G. brevifolia* as a variety of *G. victoriae*. Makinson (1996) in his account of *Grevillea* in *Flora of Victoria* followed McGillivray and Makinson (1993) in treating *G. brevifolia* as part of the broader concept of *G. victoriae*, under race 'e'. Molyneux and Stajsic (2000) re-instated *G. brevifolia* to specific rank, with two subspecies recognised. Subsequent to Makinson (2000), additional data has come forth about both *G. brevifolia* and *G. polycladia*, notably information about

the nature of the angle of pollen-presenter in relation to the style and the shape of the pollen-presenter in eross-seetion, whieh was either poorly known or unavailable when we published the name *G. brevifolia* subsp. *polychroma*. A new population of *G. polychroma* from near Mt Hoad was only recently diseovered whieh further showed the eonsisteney of the pollen-presenter eharacter differenees between *G. brevifolia* and *G. polychroma*. We feel that *G. brevifolia* subsp. *polychroma* is better accorded species rank as we have done in this paper.

Grevillea brevifolia is congruent with 'raee e' of MeGillivray & Makinson (1993) and Makinson (1996) and 'unassigned' speeimens 3 and 'unassigned' 6 of McGillivray & Makinson (1993). MeGillivray & Makinson eite the Wakefield 2953 (MEL 1510628) speeimen from Native Dog Flat ('unassigned 3' of MeGillivray & Makinson) as sharing features with their races 'e' (*Grevillea brevifolia*) and raee 'f', eommenting that the leaves are mostly narrowly elliptieal-ovate and glossy on the upper surface. However MeGillivray & Makinson's concept of raee 'f' encompasses both *G. polychroma* and *G. parvula*. Both *G. brevifolia* and *G. polychroma* have a glossy leaf upper surface. We consider that MeGillivray & Makinson's 'unassigned 3' to be a part of the variation exhibited within *G. brevifolia*. MeGillivray & Makinson's 'unassigned 6' from Merryangaah based on Costin *s.n.* (NSW 93308) differs from other populations of *G. brevifolia* in having a subaeute perianth-limb. The Forbes 606 (MEL 603586) colleetion from Merryangaah Peak also has a more or less subaeute perianth-limb. Until further field studies are undertaken we plaee unassigned 6 within the broader eoncept of *G. brevifolia*. The Costin and the Forbes speeimens are the only vouchered specimens of *G. brevifolia* in New South Wales.

Olde & Marriott (1995) treated *G. brevifolia* under the name *G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.)

The D. Parkes EG157 (MEL 1543216) speeimen from Bowen Traek (1 km northeast of Splitter's Range track junetion, east of Omeo) has relatively larger leaves (up to 49 mm long) and longer floral raehises (up to 35 mm long) than any other populations. In Deeember 2003 one of us (Molyneux) visited the Bowen Traek site but was unable to loeate any populations of *G. brevifolia*. The absenee of *G. brevifolia* from the Bowen Traek eould not be explained by the reeent fires. but is more likely explained by an ineorreet loeality eitation by the original colleetor (D. Parkes pers.comm. 2004). The most likely eorreet site for this population is on the Scrubby Track (C. Smith pers.comm. 2004). The taxon does occur on a northeast braneh traek leading to the type loeality Mt Tambo further along the Splitters Range Traek.

Grevillea brevifolia can be confused with *G. polychroma*, but is separated by the following eharaeters: *G. brevifolia* often tends to be a dense, rigid spreading shrub, whereas *G. polychroma* is generally more open (also spreading) in habit, but it can reach 3 m high. *Grevillea brevifolia* typieally has thicker-textured, smaller, more leathery leaves, than *G. polychroma*, and the leaf length to width ratio is also slightly lower (1.92–) 2.0–2.5:1 (–3.2:1) versus (2.0-) 2.4–3.0:1 (–4.22:1). *Grevillea brevifolia* tends to have shorter (0–) 3–7 (–11) mm long, and thicker (1.0–) 1.2-1.4 (–1.8) mm wide, primary peduneles than *G. polychroma* (0–) 6–15 (–21) mm long and 0.8–1.0 mm wide. The perianth outer surfaee below the limb in *G. brevifolia* is red or reddish-pink, whereas the perianth eolour in *G. brevifolia* varies from red or reddish-pink, pink, orange, yellow or eream. Perhaps the most notable differenee between *G. brevifolia* and *G. polychroma* is the nature of the pollen-presenter. In *G. brevifolia* the pollen-presenter is oblique to the style, not concurrent with the style and the face of the pollen-presenter is flat or slightly convex in cross-seetion. In eontrast, the pollen-presenter in *G. polychroma* is lateral to the style, concurrent with the style and the faee of the pollen-presenter is flat (or in some plants from the Mt Elizabeth population the lower margins of the pollen-presenter faee are slightly incurved giving appearance of being slightly eoncave). The differenees between the two speeies and *G. victoriae* are summarised in Table 2.

Table 2. A summary of the diagnostic characters for *G. victoriae* subsp. *victoriae*, *G. victoriae* subsp. *nivalis* *G. brevifolia* and *G. polychroma*.

Character	*G. victoriae* subsp. *victoriae*	*G. victoriae* subsp. *nivalis*	*G. brevifolia*	*G. polychroma*
Branchlet indumentum	Subsericeous	Subsericeous to subtomentose	Subsericeous to subtomentose	Subsericeous to subtomentose
Leaf length & width (mm)	(30-)40–120(–200) x (8–)10-25(–50)	(20–)35–100(–135) x (7–)15–35	(8–)21–38(–49) x 6–16(–20)	(11–)33–68(–70) x (6–)12–23(–30)
Leaf length:width ratio	4.0:1–5.0:1 (–6.0:1)	2.25–4.0:1 (-5.0:1)	(1.92:1–) 2.0–2.5:1 (–3.2:1)	(2.0:1–) 2.3–3.0:1 (–4.3:1)
Leaf upper surface lateral veins	Conspicuous	Conspicuous to prominent	Obscure	Obscure to evident
Leaf texture	Leathery, thick	Leathery, thick	Leathery, thick	Soft (thin), flexible
Leaf lower-surface indumentum	Densely sericeous or occasionally densely subsericeous, epidermis not visible	Densely subsericeous or densely subtomentose, epidermis not visible	Densely sericeous or subsericeous, epidermis not visible	Densely sericeous or subsericeous, epidermis not visible or partially visible
Leaf lower-surface venation	Lateral veins usually conspicuous, reticulum absent	Lateral veins conspicuous or occasionally evident, reticulum conspicuous or rarely obscure or absent	Lateral veins obscure to evident, reticulum absent	Lateral veins obscure to evident, reticulum absent or obscure
# of flowers/unit-conflor.	22–48 (–60)	(16–) 24–46 (–68)	(14–) 20–22 (–30)	(12–) 28 (–44)
Primary peduncles l x w (mm)	(0–)3–17 x 1.2–1.6	(0–)3.5–13.5 x (1.0–)1.3–1.5	(0–)3–7(–11) x (1.0–)1.2–1.4(–1.8)	(0–)6–15(–21) x 0.8–1.0
Floral rachis length (mm)	(17–)40-90	(8–)10–50 (-60)	(7–)15–20 (–35)	(11)14–20 (–32)
Peduncle branching	Simple 69%; Once 20%; Twice 9%; Thrice 2 %	Simple 43.16%; Once 47%; Twice 7.84%; Thrice 2 %	Simple 77%; Once 21%; Twice 2%	Simple 69%; Once 26%; Twice 4%; Thrice 1%
Perianth outer surface below the limb colour	Red or reddish-pink	Red or reddish-pink	Red or reddish-pink	Red or reddish-pink, pink, orange, yellowish or cream
Pollen-presenter angle to style	Oblique to the style	Oblique to the style	Oblique to the style	Lateral to the style
Face of pollen-presenter	Flat or slightly convex in cross-section, base not concurrent with the style	Flat or slightly convex in cross-section, base not concurrent with the style	Flat or convex in cross-section, base not concurrent with the style	Flat or slightly concave in cross-section, base concurrent with the style

The differences in size and shape of the floral bracts between the two taxa used in Molyneux and Stajsic (2000) was based on very few specimens, and its diagnostic use required validation as we pointed out in that work. Extensive examination of herbarium specimens and live material has shown this character to be of no value, the floral bracts of the two taxa being very similar.

No intermediates between *G. brevifolia* and *G. polychroma* have been found. The two species occupy different habitats, with *G. brevifolia* being predominantly confined to subalpine and alpine woodlands, whereas *G. polychroma* is found from low riparian sites down to 80 m above sea level to montane forest.

G. brevifolia is distinguished from *G. victoriae* by its shorter, generally more obtuse leaves, (8–) 21–38 (–49.5) mm long x 6–16 (–20) mm wide, and the leaf to length ratio (1.92–) 2.0–2.5:1 (–3.2:1). The leaf upper surface lateral veins in *G. brevifolia* are obscure rather than conspicuous as occurs in *G. victoriae*. The unit conflorescences in *G. brevifolia* are generally fewer flowered, and the floral rachis is shorter.

Grevillea callichlaena Molyneux & Stajsic, *sp. nov.*

A *G. miqueliana* F. Muell. surculis novis salmoneis, alabastris omnino rubro-ferrugineis, limbo perianthii majore ((3.8-) 4.0-4.8 mm e latere viso) et tepalis dorsalis latioribus (1.9-2.5) mm differt.

Type: Victoria, Eastern Highlands, Alpine National Park, 350 m WSW from summit of Mt Benambra, on W side of track near track edge, 22. x. 2002, *V. Stajsic* 3308 & *W.M. Molyneux, S.G. Forrester, H. Merkel, P. Asluton* (holo: MEL 2190704!; iso: AD!, BRI!, CANB!, HO!, NSW!, K!, NY!, WELT!).

Spreading to erect *shrub* 1.5–1.8 (–3) m high, 2–3.5 (–4) m across. *Branchlets* terete, subterete or biconvex in cross-section with several longitudinal ridges, densely subvillous of biramous non-glandular hairs, epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly ascending hairs with some appressed hairs, straight and wavy hairs, the hairs off-white and tan-coloured, with an overlayer of irregularly aligned, straight and wavy hairs, the hairs predominantly erect and suberect, Y-shaped, off-white and tan-coloured. *Colour of new growth* salmon-pink or salmon-pink and ferruginous on the same plant, soon becoming green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, ovate, elliptic, broadly elliptic or broadly lanceolate, narrow obovate to obovate, (26–) 37–75 (–92) mm long, (12–) 19–28 (–43) mm wide, apex obtuse, or with short blunt mucro, *margins* rolled downwards or shortly recurved: *leaf length to width ratio* 2.7–1; *leaf upper surface* granulose (persistent hair bases), dull, moderate-green, *lateral veins* conspicuous; *reticulum* obscure; *leaf lower surface* loosely subvillous of biramous of non-glandular hairs, epidermis visible, the hairs mutually aligned and irregularly aligned, predominantly suberect hairs with fewer ascending hairs, predominantly Y-shaped, the hairs straight and wavy, off-white or silvery-white hairs with scattered tan-coloured and ferruginous hairs predominantly on the veins, *lateral veins* conspicuous, *reticulum* conspicuous, *leathery-textured*. *Conflorescences* terminal on main branchlets or on short side branchlets, rarely subcauline, decurved to pendulous, pedunculate, simple to twice-branched, simple 86.53%, once-branched 9.62%, twice-branched 3.85%, *unit conflorescence* cylindrical or dome shaped, acropetal; *number of flowers* (8–) 20–40 (–64) per unit conflorescence; *primary peduncles* (4–) 5–22 (–35) mm long, 1.5–2 mm wide, indumentum (as in rachises) very densely subvillous of biramous non-glandular hairs, epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly ascending with some appressed hairs, straight and wavy, the hairs off-white and tan-coloured with scattered ferruginous hairs, with an overlayer of irregularly aligned, predominantly erect and suberect Y-shaped hairs, straight and wavy hairs, off-white and tan-coloured, overall

colour dirty-white, off-white or pale tan-coloured (as in rachises); *floral rachises* (5–) 35–50 (–65) mm long; *floral bracts* narrowly-triangular, linear-crescentic in side-view, basally truncate, apex acute but blunt-tipped, 1.5–1.8 mm long, 0.3–0.5 mm wide, outer surface densely tomentose of biramous non-glandular hairs, epidermis not visible, with predominantly irregularly aligned, predominantly ascending with occasional appressed hairs, straight and wavy hairs, tan-coloured, inner surface glabrous except just below apex, reddish-brown, bracts persistent until buds 1.7–1.8 mm long; *pedicels* 2.5–4.2 mm long; *torus* oblique to pedicel at 15–45°, squarish in plane-view with rounded angles; *very early flower buds* wholly ferruginous, perianth below the limb maturing to red-ferruginous, limb maturing to ferruginous; *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* roundish in cross-section; *perianth outer surface below the limb indumentum* densely subvillous of biramous non-glandular hairs, epidermis not visible or partially visible, with a lower layer of mutually and irregularly aligned, appressed and ascending hairs, the hairs straight and wavy, reddish-ferruginous, with usually an overlayer of irregularly aligned, predominantly erect, Y-shaped hairs, straight and wavy, epidermis red; *perianth inner surface epidermis below the limb* with minute papillae below beard, papillae particularly obvious along margin, glabrous except for beard, red; *dorsal tepal beard* commencing 1.5–2 mm above toral rim, beard extending for 4–5.4 mm, hairs 1–1.2 mm long; *perianth-limb* (3.8–) 4.0–4.8 mm wide in side-view, globose in side-view, round face-on, apex obtuse, limb-segments not keeled on outer surface, indumentum dense and intermediate between tomentose and villous of biramous non-glandular hairs, with a lower layer of predominantly mutually aligned, appressed and ascending red hairs with an overlayer of irregularly aligned, predominantly erect (with some ascending hairs) Y-shaped variably wavy/curled hairs ferruginous hairs, epidermis not visible, epidermis red; *ventral tepal beard* commencing 3.5–5.0 mm above toral rim, beard extending for 2.5–3.5 mm, hairs 0.8–1.5 mm long; *dorsal tepals* 20.5–22 mm long, 1.9–2.5 mm wide; *nectary* half-annular, projecting 0.4–0.6 mm above toral rim, margin with two lateral teeth and 2 obscurely raised central teeth or irregularly toothed or tridentate, pale-yellow; *pistil* 19.5–22 mm long; *stipe* 1.5–2.2 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth before release of style-end, bowed, afterwards nearly straight to incurved, with scattered minute spreading simple hairs predominantly in the upper 1/2 or upper 1/3 of style length, particularly at back of style-end, cherry-red; *pollen-presenter* strongly oblique to style, 2.5–3.2 mm long, 2–2.5 mm wide; *face of pollen-presenter* flat to slightly convex in side-view, base not concurrent with the style; stigma distally off-centre; *follicle* ovoid/ellipsoid, 18–20 mm long, to 7 mm deep, wall 0.5–0.6 mm thick, glabrous, faintly colliculose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1 b.)

Representative specimens examined: **VICTORIA**. Eastern Highlands: Alpine National Park. 350 m WSW from summit of Mt Benambra, on W side of track near track edge, 6. xi. 2000, *H. Merkel s.n* (MEL 2117811); Primarily on N side of track leading to the summit of Mount Benambra fire tower, ca. 250 m SW of the summit, 22. x. 2002, *V. Stajsic* 3309, 3310, 3311, *W.M. Molyneux, S.G. Forrester, P. Ashton & H. Merkel* (MEL 2190706, 2190708, MEL (Vic. Ref. Set), NSW; MEL 2190709, NSW); on North side of Mount Benambra fire tower, 22. x. 2002, *V. Stajsic* 3312, 3313, *W.M. Molyneux, S.G. Forrester, P. Ashton & H. Merkel* (Seedlings: MEL 2190710; CANB, MEL 2190711, NSW).

Phenology: Flowering has been recorded between October and March, but in the absence of snow can occur sporadically throughout the year. Nectarivorous birds, in particular honeyeaters of various species visit the flowers and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: A very narrow endemic, known only from two localised populations at Mt Benambra, in the Alpine National Park in Victoria. The fires

of January 2003 swept through the Mt Benambra region, killing most plants outright, severely depleting the population. Prior to the January 2003 fires, *G. callichlaena* was a co-dominant shrub in the understorey with *Oxylobium ellipticum*. Fortunately numerous seedlings have recently been observed throughout the site (H. Merkel 2004 pers. comm.). A conservation status of Endangered (2Ea *sensu* Briggs & Leigh 1996) or Endangered (EN *sensu* IUCN 2001) is suggested.

Habitat and Ecology: Mt Benambra is of Lower Devonian Rhyolite geology. The summit where the two populations often grow amongst scattered boulders has a dominant overstorey of *Eucalyptus pauciflora*, and a dominant lower and shrub layer of *Grevillea callichlaena* and *Oxylobium ellipticum*. Other associated species include: *Acacia rubida, Coprosma hirtella, Dianella tasmanica, Derwentia derwentiana, D. perfoliata, Joycea pallida, Leucopogon maccraei, Kunzea ericoides, Polyscias sambucifolia, Polystichum proliferum, Senecio gunnii* and *Stellaria pungens*. Prior to the devastating fires of January 2003 there was no evidence of recent fires at Mt Benambra (P. Ashton pers. comm. 2003).

There are no records of vegetative reproduction. Plants are killed outright by fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long-term survival of some populations if the period between the burns is not long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that part of the two populations at Mt Benambra also occur along the vehicle-track, care must be taken not to eliminate these plants through road works.

Etymology: From the Greek *callos*, beauty, and *chlaena*, a cloak or covering, refers to densely subvillous, reddish-ferruginous perianth outer surface.

Notes: It appears that material of *Grevillea callichlaena* was first collected and cultivated by Mr. Martin Rigg of Yackandandah in the early 1990's, but no voucher specimen was lodged at any herbarium (M. Rigg & N. Marriott pers.comm. 2005). Mrs. Heather Merkel of Tallangatta was the first person to submit a voucher specimen to MEL in November 2000. The existence of this species was unknown to botanists prior to her collection.

Grevillea callichlaena exhibits some variation in leaf size and shape but is generally very uniform morphologically in other characters. Vegetatively it is most similar to *G. miqueliana* subsp. *miqueliana*, but it has consistently granulose leaf upper surfaces. *G. callichlaena* differs from *G. miqueliana* in having the new growth usually salmon-pink or a combination of salmon-pink and ferruginous on the same plant, and the leaf upper surfaces are consistently granulose. The flower buds (all developmental stages) are wholly reddish-ferruginous compared with the very early flower buds in *G. miqueliana* having the perianth (below the limb) usually pale silvery-lilac which matures to pink or pinkish-red, and the perianth-limb dirty brownish-grey and maturing to dirty brownish-grey. The perianth outer surface below the limb in *G. callichlaena* never has a central blotch on the ventral tepals as is often present in *G. miqueliana*. The perianth outer surface below the limb in *G. callichlaena* is usually densely subvillous obscuring the epidermis, less often moderately densely subvillous with epidermis slightly visible. In *G. miqueliana* the perianth outer surface below the limb is usually loosely subvillous, or ± moderately densely subvillous (in subsp. *miqueliana*), or loosely subtomentose (in subsp. *cincta*) with the epidermis clearly visible. The perianth-limb (just prior to release of style-end) is larger in *G. callichlaena*, (3.8–) 4.0–4.8 mm wide in side-view, compared with 2.5-3.2 mm wide in side-view in *G. miqueliana*. The inner surface of the recurved portion of the perianth below the limb in an open flower is uniformly pinkish-red, not bichromatic as usually occurs in *G. miqueliana*. The dorsal-tepals are also wider in *G. callichlaena*, 1.9–2.5 mm wide, compared with 1.2–2.2 mm in *G. miqueliana*.

Grevillea epicroca Stajsic & Molyneux, in Makinson (2000), *Flora of Australia* 17A: 502.

Type: New South Wales, Southern Tablelands scarp: Merricumbene Fire Trail, 18.4 km S of Bateman's Bay road, ca 19 km SW of Braidwood, 30 Mar. 1976, *M.D. Crisp 2008* (holo: CANB (CBG 68600)!, iso: AD *n.v.*, BRI *n.v.*, L *n.v.*, NSW 450182!, PERTH *n.v.*)

G. victoriae F. Muell 'unassigned 5', of D.J. McGillivray & R.O. Makinson, *Grevillea*: 322 (1993).

Spreading to erect *shrub*, 1.5–2.5 m high, to 3 m across. *Branchlets* distinctly angular to subangular in cross-section becoming terete away from apex, with several longitudinal ridges, (indumentum mostly present near ends of branchlets, quickly becoming glabrescent), moderately densely or loosely sericeous or subsericeous, of biramous non-glandular hairs, epidermis not visible, partially visible or clearly visible, the hairs predominantly mutually aligned, appressed or slightly ascending, straight, off-white or silvery-white hairs, with or without occasional irregularly aligned, appressed, ferruginous hairs. *Colour of new growth* initially salmon-pink, becoming green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, oblong-ovate, elliptical to narrowly elliptical, (30–) 50–70 (–80) mm long, (8–) 10–15 (–20) mm wide, apex acute to subacute or obtuse with a short blunt mucro, *margins* very shortly recurved or revolute; *leaf length to width ratio* (3:1–) 4:1–6:1; *leaf upper surface* glabrous, obscurely to conspicuously minutely foveolate, or with occasional appressed silvery-white hairs, with tan-coloured hairs (in younger leaves), glossy, mid-green to dark-green, *lateral veins* evident to conspicuous, *reticulum* absent; *leaf lower surface* loosely sericeous, epidermis clearly visible, the hairs mutually aligned, appressed or occasionally with scattered irregularly aligned hairs, straight, short, silvery-white with occasional irregularly aligned appressed tan-coloured or ferruginous hairs, *lateral veins* obscure to evident, *reticulum* absent, *slightly leathery textured*. *Conflorescence* terminal, subterminal or axillary, decurved to pendulous, pedunculate, simple to thrice-branched, simple 57%, once-branched 27%, twice-branched 12%, thrice-branched 4%; *unit conflorescence* ovoid or a loose sometimes subsecund cluster, acropetal; *number of flowers* (14–) 16–32 per unit conflorescence; *primary peduncles* (0–) 4.5–10 mm long, 0.7–1.0 mm wide, indumentum (as in rachises) moderately loosely sericeous or loosely subsericeous, of biramous non-glandular hairs, epidermis visible, the hairs mutually aligned, predominantly appressed with scattered slightly ascending hairs, predominantly straight with occasional ± slightly wavy hairs, off-white or silvery-white hairs with occasional irregularly aligned ± overlying tan-coloured and or ferruginous hairs, overall colour (as in rachises) off-white or pale tan-coloured; *floral rachises* 10–25 mm long; *floral bracts* narrowly-triangular, crescentic in side-view, basally truncate, apex acute but blunt-tipped, 1.3–1.7 mm long, 0.4–0.5 mm wide, outer surface densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight, ferruginous, with occasional slightly ascending, mutually aligned or slightly irregularly aligned hairs, inner surface glabrous except for the upper 1/3–1/4 of bract length, bracts persistent until buds 1.2–1.3 mm long; *pedicels* 3–3.7 mm long; torus oblique to pedicel at ca. 45°, squarish in plane-view with rounded angles; *very early flower buds* wholly ferruginous or tan-coloured, perianth below the limb maturing to red, limb maturing to ferruginous, *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* squarish with rounded angles in cross-section; *perianth outer surface below the limb* moderately densely subsericeous of biramous non-glandular hairs, epidermis usually partially visible or occasionally not visible, the hairs predominantly mutually aligned, appressed with scattered, irregularly aligned, appressed and slightly ascending hairs, straight with occasional ± slightly wavy hairs, occasionally with scattered minute spreading glandular hairs near base of perianth or in the lower 1/4 of perianth below the limb length (evident in fresh flowers and spirit preserved specimens only), reddish, tan-

coloured and ferruginous hairs intermixed, epidermis red or reddish-pink; *perianth inner surface epidermis below the limb* minutely papillate below beard, glabrous except for beard, pale red or reddish-pink; *perianth-limb* subglobose in side-view, squarish face-on, obtuse, limb-segments slightly midline-keeled on outer surface, densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, straight, appressed, ferruginous hairs with scattered, irregularly aligned, appressed and slightly ascending hairs, epidermis red or reddish-pink; *dorsal tepal beard* commencing 2.0–2.5 mm above toral rim, beard extending for 5.7–6.2 mm, hairs 1–1.2 mm long; *ventral tepal beard* commencing 3.0–3.5 mm above toral rim, beard extending for 3.0–3.5 mm, hairs ca. 1 mm long; *dorsal tepals* (16.7–)18–19.5 mm long, 1.4–1.8 mm wide; *nectary* half-annular, projecting 0.3–0.5 mm above the toral rim, margins entire or tridentate, pale-yellow; *pistil* 18–19.5 mm long; *stipe* 2–2.5 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth before release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs mostly occurring in the upper 1/2–3/4 of style length, particularly at back of style-end, red or reddish-pink; *pollen-presenter* lateral to style, 2.4–2.6 mm long, 2.2–2.4 mm wide; *face of pollen-presenter* concave in cross-section, base concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, 18–23 mm long, ca. 6.5 mm wide, wall 0.5–0.7 mm thick, glabrous, faintly colliculose-rugulose, with three to four longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1 e.)

Representative specimens examined: **NEW SOUTH WALES.** South Coast/Southern Tablelands: Downstream on Deua R [River] 1/4 mile from 'Alpine' property above junction of Deua R [River] & Curmulee Creek, 24. iv. 1966, *T. Whaite* 3088 & *J. Whaite* (NSW 82871); Merricumbene Fire Trail, c. 1 km N of Bendethera Mountain, 29. v. 1973, *R. Pullen* 4729 (CANB, MEL 647496, NSW 450195); c. 1 km NE along boundary fire trail from junction of River Forest Road and Gollarribee Fire Trail, 14 km S of Monga, 4. xi. 1989, *P. Ollerenshaw* 1806 (CBG, MEL 273077, NSW); Deua National Park, Merricumbene Fire Trail 1.4 km N from Bendethera Trig, 24. x. 1996, *V. Stajsic* 2467-2471 (AD, CANB, HO, MEL 2116323, 2116325, 2116327, 2116329, 2116331, 2116332, NSW).

Phenology: Flowering has been recorded from October to May, but can occur sporadically throughout the year. Nectarivorous birds, in particular honeycaters of various species visit the flowers and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: Grevillea epicroca is apparently confined to Deua National Park in the South Coast/Southern Tablelands region of New South Wales and may be endemic to the park. To date it is known primarily from a small number of collections made in the vicinity of Bendethera Trig on the Merricumbene Fire Trail. The only other geographically significant collections are Whaite 3088 (NSW 82871) collected downstream on the Deua River '1/4 mile' from 'Alpine' property above the junction of Deua River and Curmulee Creek (which is ca.12-13 km north-west from the Merricumbene Fire Trail population) and Ollerenshaw 1806 (MEL 273077) collected 1 km from the junction of River Forest Rd and the Gollarribee Fire Trail (just north of the Merricumbene settlement (ca.30 km north-east from Bendethera Trig). The Ollerenshaw collection may just fall within the boundary of National Park or just shortly outside the park into the Monga State Forest or the Quart Pot State Forest. A cursory count of the number of plants at the type-site in 1996 by one of us (Stajsic) revealed only 24 plants ranging from juvenile under 1m high to mature shrubs to 2.5 m high. Deua National Park is very rugged topographically and it is very likely that other populations exist in more remote and inaccessible places. The collecting notes of the Whaite 3088 (NSW 82871) specimen comment that the plants were frequent in a limited area. A conservation status of Endangered (2ECi *sensu* Briggs & Leigh 1996) or Endangered (EN *sensu* IUCN 2001) is suggested.

Habitat and Ecology: This rarely collected species is known from only a small number of herbarium specimens that provide relatively little ecological information. The geology at the type-site is Comerong Volcanics rhyolite, and the plants grow in grey loam

soil derived from this. The plants grow on a ridge top in dry open forest dominated by *Eucalyptus sieberi*, which grades sharply to *Eucalyptus fraxinoides* on the slopes below the ridge (Stajsic pers. observ. 1996). The collection notes on Whaite 3088 (NSW 82871) comment that the plants were collected on a phyllite ridge. This site is at a much lower altitude approximately between 250–300 m above sea level. The collecting notes on the Ollerenshaw specimen comment that the plants were growing on a very steep ridge, somewhere between 400–600 m above sea level.

There are no records of vegetative reproduction. Plants are killed outright by fire and regeneration is from seed only, as demonstrated by the December 2001/January 2002 fires that swept through extensive areas of Deua National Park, killing all the plants at the type-site. A visit by one of us (Stajsic) with Bob Coveny and Andrew Orme (both of NSW) to the type-site in September 2002 failed to find any regeneration, but on a later visit in October 2003 by Andrew Orme (NSW) and Peter Olde seedlings were observed (A. Orme pers.comm. 2003). The Gollarribee site, which apparently escaped the fires at the time, was also visited in Sept 2002 by one of us (Stajsic) with Bob Coveny and Andrew Orme but no plants of *G. epicroca* were found. Long-term fire regimes may be significant for local populations. Given that at least part of one population (i.e. type-site population) occurs along the four-wheel drive track, care must be taken not to eliminate these plants through road works.

Notes: Grevillea epicroca corresponds with the 'unassigned specimen 5' in McGillivray & Makinson (1993). Given the superficial similarity of *G. epicroca* with the previously understood concept of *G. victoriae* var. *leptoneura* it is likely that *G. epicroca* would have been placed with var. *leptoneura* as indicated by Crisp 2008 specimen (holotype), determined as *Grevillea* aff. *victoriae* F.Muell. var. *leptoneura* Benth.

G. epicroca is similar to *G. parvula* and can be separated by the following characters: the branchlets of *G. epicroca* are distinctly angular or subangular compared with terete, subterete, concavo-convex or plano-convex in cross-section, seldom subangular branchlets in *G. parvula*. The branchlets in *G. epicroca* are sericeous, loosely sericeous or glabrescent with scattered mutually aligned, appressed silvery-white hairs, in contrast to the densely subvillous branchlets in *G. parvula*. The loosely sericeous indumentum of the leaf lower surface in *G. epicroca* distinguishes it from *G. bemboka*, *G. brevifolia*, most populations of *G. parvula* (for exceptions, see that species), *G. oxyantha*, *G. polychroma* and *G. victoriae*. Taxa with a similar lower leaf surface indumentum include *G. monslacana* which differs in having branchlets terete, subterete or biconvex in cross-section and densely tomentose. *G. monslacana* also differs in perianth-line not being midline-keeled on the outer surface, the pollen-presenter is convex in cross-section, at an oblique angle to the style, and not concurrent with the style.

G. rhyolitica may have an open indumentum on the leaf lower surface, but either has spreading hairs (in *G. r.* subsp. *rhyolitica*), or the hairs are appressed but very short and almost rhombic in shape (in *G. r.* subsp. *semivestita*), and in either case the perianth outer surface is tomentose.

A number of collections (*Olsen* s.n. NSW 128904; *Crisp* 2389, *D.J. Cummings & A. Tyrrel* NSW 452938; *D.J. Cummings* 41, *M.D. Crisp & A. Tyrrel* NSW 450183; *D.J. Cummings* 42, *M.D. Crisp, & A. Tyrrel* NSW 450181) east of Big Badja at the southern extension of the Minuma Range in the Southern Tablelands escarpment of New South Wales appear to be similar to *G. epicroca*. These collections are congruent with the 'unassigned specimen 4' of McGillivray & Makinson (1993). These collections share some points of similarity between *G. bemboka*, *G. parvula* and *G. epicroca*. The specimens have obovate or narrow-obovate leaves, 25-65 mm long x 8-20 mm wide, the leaf upper surface venation is obscure or evident, the leaf lower surface is subsericeous, the perianth-limb obtuse and slightly keeled. They are here treated as unassigned. See also Notes section for *G. bemboka*.

Grevillea miqueliana F.Muell., *Trans. & Proc. Victorian Inst.* 1: 132 (1855)

Type: [Victoria], '...near Mt McMillan, and along the upper valleys of the Avon in Gipp's Land.' [protologue]; lecto: [Victoria], In montibus 3–4000' altis dumosis petraeis inter Castle hill & Mount Angus.fr. [frutex] 4–5' alt., *Dr. M.* [*F. Mueller*] *s.n* Nov 54 [in error ? probably xi. 1853] (lecto: *fide* D.J. McGillivray & R.O. Makinson *Grevillea*: 447 (1993), MEL 65738!); residual syntypes: Avon Ranges, *s.d.*, *F. Mueller s.n.* (syn.: A *n.v.*, K–Neg.No.Kew 2281!, syn.: MEL 65736!, 65737!, 65739!, 65743!; Avon River 4000 ft Gipps Land. *n.d.*, [F. Mueller] (TCD *n.v.*); Mount Angus *s.d.*, *F. Mueller* (NSW 93343; the specimen labeled 'no locality', *F. Mueller* [NSW 93345] appears to be part of the same collection as NSW 93343); probable part of a syntype collection: Gipps Land, *s.d.*, Dr. Mueller (K– 'Presented by the Linnean Society, 1915', *n.v.*).

Spreading to erect *shrub* (0.5–) 1.5–2.0 (–3) m high, (1.0–) 2–4 (–7) m across. *Branchlets* terete, subterete or biconvex in cross-section, with several longitudinal ridges, densely subvillous or subtomentose (in subsp. *cincta*), of biramous non-glandular hairs, epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly ascending or appressed hairs, straight and wavy hairs, the hairs off-white or silvery-white, with an overlayer of irregularly aligned, predominantly erect and suberect or predominantly ascending Y-shaped hairs, straight and wavy hairs, off-white or silvery-white. *Colour of new growth* ferruginous, soon becoming green. *Leaves* ascending (towards apex of shoot), petiolate, simple, entire, narrowly elliptical to broadly elliptical, ovate, obovate to occasionally broad-obovate (only occasional leaves in subsp. *miqueliana*), (9–) 20–80 (–95) mm long, (5–) 8–23 (–36) mm wide, apex acute or obtuse with a short blunt mucro or occasionally emarginate, *margins* more or less flat, rolled downwards, slightly revolute, or strongly revolute (in subsp. *moroka*); *leaf length to width ratio* 1.70:1–3.80:1; *leaf upper surface* glabrous and minutely foveolate or distinctly granulose (persistent hair bases, ca. 0.1 mm high) and or with longer biramous non-glandular hairs 0.2–0.3 mm high, often glossy (in subsp. *miqueliana* and *cincta*) or dull (in subsp. *moroka*), mid to dark-green, *lateral veins* obscure to evident, *reticulum* absent; *leaf lower surface* loosely villous of biramous non-glandular hairs (in subsp. *miqueliana* and subsp. *moroka*), epidermis clearly visible, the hairs irregularly aligned, predominantly erect and subercct, predominantly Y-shaped, straight and wavy, off-white or silvery-white with scattered tan-coloured hairs with occasional ferruginous hairs predominantly on the veins, OR subtomentose or loosely subsericeous (in subsp. *cincta*), of biramous non-glandular hairs, epidermis clearly visible, the hairs predominantly mutually aligned, appressed and ascending, straight with occasional ± slightly wavy, off-white and silvery-white hairs with or without tan-coloured and ferruginous hairs predominantly on the veins, *lateral veins* conspicuous to prominent, *reticulum* evident or absent, usually *soft-textured* in subsp. *cincta* and subsp. *miqueliana*, ± *leathery-textured* in subsp. *moroka*. *Conflorescences* terminal on main branchlets, rarely axillary on short side branchlets or subcauline, decurved to pendulous, pedunculate, simple to three branched; *unit conflorescence* a loose ovoid to shortly cylindrical cluster, acropetal; *number of flowers* (12–) 18–36 (–40) per unit conflorescence; *primary peduncles* (0–) 5–12 (–20) mm long, (0.8–) 1.0–1.5 (–1.7) mm wide, loosely to densely subvillous or tomentose (in subsp. *miqueliana* and subsp. *moroka*), of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs irregularly or mutally aligned, erect and suberect or ascending, straight and wavy predominantly Y-shaped hairs, off-white or silvery-white, with or without scattered tan-coloured and ferruginous hairs, OR subtomentose (in subsp. *cincta*) of biramous non-glandular hairs, epidermis visible or not visible, the hairs predominantly mutually aligned, appressed and ascending, predominantly straight with occasional ± slightly wavy hairs, off-white or silvery-white, *overall colour (as in rachises)* off-white, dirty-whitish or greenish-white; *floral rachises* (5–) 12–42 mm long; *floral bracts* narrowly-triangular, crescentic in side-view, basally truncate, apex acute but blunt-tipped, 2–4.2 mm long, 0.3–0.6 mm wide, outer surface

densely subvillous hairs (in subsp. *miqueliana* and subsp. *moroka*) or tomentose, of biramous non-glandular, epidermis not visible, with a lower layer of predominantly mutually aligned, predominantly ascending, straight and wavy hairs, off-white and tan-coloured, with an overlayer of irregularly aligned, predominantly erect and suberect, straight and wavy hairs, off-white and tan-coloured, with scattered ferruginous hairs, persistent until buds 1.5–2 mm long; *pedicels* 3–5.2 mm long; torus oblique at a 15–45° angle to the pedicel, squarish in plane-view with rounded angles; *very early flower buds* with the perianth below the limb usually pale silvery-lilac, the limb dirty brownish-grey, perianth outer surface below the limb maturing to pink or pinkish-red, ventral tepals wholly pink or pinkish-red, or pink or pinkish-red at apex and near base of the tepals and with a yellowish or pale yellowish-orange or orange blotch in the centre of tepals, limb maturing to dirty brownish-grey; *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* squarish in cross-section; *perianth outer surface below the limb* loosely subvillous (in subsp. *miqueliana* and *moroka*) or loosely subtomentose of biramous non-glandular hairs (in subsp. *cincta*), epidermis clearly visible, the hairs irregularly or mutually aligned, suberect and erect or appressed Y-shaped or straight hairs, with scattered irregularly aligned, ascending hairs, predominantly wavy, predominantly ferruginous with scattered tan-coloured hairs, epidermis red or reddish-pink (except for central blotch on ventral tepals); *perianth inner surface epidermis below the limb* minutely papillate, with papillae usually larger and becoming minute simple hairs at or near margins, papillae rarely extending above beard, glabrous except for beard, the recurved portion of the perianth in an open flower usually bichromatic, dorsal tepals pinkish-red in the inner half of tepal length (i.e. adjacent to where the lateral margins of the dorsal tepals meet each other), yellow in the outer half of tepal length (i.e. adjacent where the lateral margins of the dorsal tepals meet the ventral tepals), the inner surface of ventral tepals wholly yellow, the outer surface usually with a central blotch and usually red or pinkish-red towards base and apex of the perianth; *perianth-limb* 2.5–3.2 mm wide in side-view, subglobose in side-view, squarish with rounded angles face-on, apex obtuse, tepals not keeled or obscurely midline-keeled on outer surface, loosely subvillous (in subsp. *miqueliana* and *moroka*) or tomentose (in subsp. *miqueliana*) of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs irregularly or mutually aligned, suberect and erect Y-shaped hairs or predominantly ascending, with occasional suberect wavy hairs, with scattered irregularly aligned ascending hairs, wavy, predominantly ferruginous, OR subtomentose or subericeous (in subsp. *cincta*) biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed and ascending with occasional irregularly aligned ascending hairs, straight with occasional ± slightly wavy hairs, predominantly ferruginous, with occasional tan-coloured hairs; *dorsal tepal beard* commencing 1.8–2.7 mm above toral rim, beard extending for (4.5–) 5.5–6.5 (–7) mm, hairs 1.2–1.5 mm long; *ventral tepal beard* commencing 3–6.5 mm above toral rim, beard extending for 1.8–3.5 (–4.5) mm, hairs 0.6–1.3 mm long; *dorsal tepals* (15–) 16–23.5 mm long, 1.2–2.2 mm wide; *nectary* half-annular, projecting (0.2–) 0.3–0.5 mm above toral rim, margins entire or tridentate, pale-yellow; *pistil* 18.2–22.5 (–23.5) mm long; *stipe* 1.5–3.2 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth prior to release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs in the upper 1/2 to 1/4 of style length, particularly at the back of the style-end, very seldom with a dense indumentum of sessile biramous non-glandular hairs near the apex (an aberrant state), pink, pinkish-red or red; *pollen-presenter* oblique to style, 1.8–2.8 mm long, 2.0–3 mm wide; *face of pollen-presenter* flat to convex in cross-section, base not concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid 15–21 mm long, 5–8 mm deep, wall 0.8–1.6 mm thick, glabrous, faintly colliculose-rugulose, with up to five longitudinal ridges on each side, firmly crustaceous, style persistent.

Notes: *G. miqueliana* has a chequered taxonomic history having been erected and subsumed and then subsequently resurrected and then again subsumed under *G. victoriae*.

G. miqueliana was first described by Mueller in 1855. Willis (1973) recognised *G. miqueliana*, citing Victorian populations from Walhalla, Mt Useful, heads of Macallister [Macalister] River, Moroka River, Mt Wellington, Mt Angus and Castle Hill, Back Creek in Cann River district, Ingeegoodbee River below Cobberas Mountains at 5000 ft. alt., and a single New South Wales population from the Upper Tuross River in New South Wales. Several taxa are encompassed by Willis's concept of *G. miqueliana*: *G. brevifolia* (probably, no specimens from Ingeegoodbee River are held at any herbaria, but the site is within the known distribution and elevation range for the species), *G. irrasa* subsp. *irrasa* (Upper Tuross River in New South Wales), *G. miqueliana* subsp. *miqueliana* (Walhalla, Mt Useful, heads of Macallister [Macalister] River, Moroka River, Mt Angus and Castle Hill), *G. miqueliana* subsp. *moroka* (Mt Wellington) and *G. parvula* (Back Creek in Cann River district). Makinson (1991) in the account of *Grevillea* for the *Flora of New South Wales* recognised a broad concept of *G. victoriae* with *G. miqueliana* relegated to synonymy under *G. victoriae*.

McGillivray & Makinson (1993) again treated the species as a synonym under a broad concept *G. victoriae* in their *Grevillea* monograph. Olde & Marriott (1995) resurrected *G. miqueliana*, with no infraspecific taxa recognized. They recognised three informal taxa: 'Typical form' (*G. miqueliana* F.Muell. subsp. *miqueliana*), 'Mt Wellington form' (*G. miquelina* F. Muell.subsp. *moroka* Molyneux & Stajsic in Makinson (2000)) and *G.* sp. aff. *miqueliana* (*G. irrasa* Makinson subsp. *irrasa*, 2000). They also alluded to the possibility that the 'form from Yowrie' may represent a further undescribed taxon (*G. irrasa* subsp. *didymochiton* Makinson, 2000). Makinson (1996) followed McGillivray and Makinson's treatment. Molyneux & Stajsic reinstated *G. miqueliana* at species rank, but additionally described *G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsic. In this paper we describe another new subspecies, *G. miqueliana* F.Muell. subsp. *cincta*.

G. miqueliana is distinguished from all other southern members of the *G. victoriae* species complex by its bichromatic flowers (*i.e.* dorsal tepals pinkish-red in the inner half of tepal length, yellow in the outer half of tepal, ventral tepals wholly yellow on inner surface, outer surface usually with a central blotch and usually red or pinkish-red towards base and apex of the perianth). This character is also usually manifested as a ventral blotch on the perianth outer surface below the limb.

G. miqueliana is distinguished from *G. victoriae* and *G. brevifolia* by its densely subvillous branchlets (except *G. miqueliana* subsp. *cincta*), the leaf upper surface often being granulose (except in *G. miqueliana* subsp. *cincta* where never granulose), the leaf lower surface is subvillous (except *in G. miqueliana* subsp. *cincta* which is loosely subsericeous or loosely subtomentose) the very early flower buds have a pale silvery-lilac perianth (below the limb) and a dirty brownish-grey limb (wholly ferruginous or perianth below the limb reddish and limb ferruginous). The floral bracts also tend to be generally longer in *G. miqueliana*, (1.7–) 2–4.2 mm long. The perianth (below the limb) inner surface in *G. miqueliana* is also bichromatic as mentioned above. See Table 3 for a summary of the differences between *G. miqueliana* and *G. victoriae*.

The northern species *G. linsmithii* and *G. mollis* both differ from *G. miqueliana* in possessing a tangible velvety indumentum on their leaf upper surface, and the unit conflorescence being 2–8 flowered. *G. linsmithii* further differs in the perianth (below the body) outer surface being mid-green in the lower half, orange-pink to bright-red in the upper half. *G. mollis* has monochromatic flowers both on the inner and outer surface.

Grevillea irrasa (both subspecies) differs in its oblong to narrowly obovate leaves, with obscure venation on both leaf surfaces, the perianth (below the limb) inner surface being monochromatic and in its lateral, concave pollen-presenter in cross-section.

Grevillea callichlaena differs in having the new growth usually salmon-pink or a combination of salmon-pink and ferruginous on the same plant, and the leaf upper

surfaces are consistently granulose. The flower buds (all developmental stages) are wholly reddish-ferruginous compared with the very early flower buds in *G. miqueliana* having the perianth (below the limb) usually pale silvery-lilac which matures to pink or pinkish-red, and the perianth-limb dirty brownish-grey and maturing to dirty brownish-grey. The perianth outer surface below the limb in *G. calliclilaena* never has a central blotch on the ventral tepals as is often present in *G. miqueliana*. The perianth outer

Table 3. A summary of the diagnostic characters which distinguish *Grevillea miqueliana* and *Grevillea victoriae*.

Character	*Grevillea miqueliana*	*Grevillea victoriae*
Branchlet indumentum	Densely subvillous, or subtomentose of biramous non-glandular hairs (in subsp *cincta*).	Densely subsericeous (in subsp. *victoriae* & *nivalis*), or occasionally densely subtomentose (in subsp. *nivalis*).
Leaf length to width ratio	1.70–3.40:1	Leaf length to width ratio 2.25–5:1 (–6.0:1)
Leaf upper surface	Distinctly granulose or microscopically asperulous (40x magnification) and smooth to touch, or glabrous.	Usually glabrous, never granulose, occasionally microscopically asperulous (40 x magnification) and smooth to touch in *G. victoriae* subsp. *nivalis*.
Leaf lower surface indumentum	Villous or subvillous (or subsericeous to tomentose in subsp. *cincta*).	Sericeous, appressed, mutually aligned hairs or subsericeous, the hairs predominantly appressed mixed with irregularly aligned ascending hairs in subsp. *nivalis*.
Number of flowers per unit conflorescence	(12–) 20–34 (–46) flowers.	(16–) 22–68 flowers.
Floral rachis length (mm)	(5–) 15–42	(8–) 10–90
Floral bract length (mm)	(1.7–) 2–4.2	(1–) 1.5–2.7
Perianth inner surface below the limb colour	Usually bichromatic (seldom monochromatic).	Monochromatic.
Very early flower bud colour	Perianth (below the limb) usually pale silvery-lilac, maturing to pink or pinkish-red, perianth-limb dirty brownish-grey, remaining dirty brownish-grey at anthesis.	Wholly ferruginous or perianth (below the limb) ferruginous, or perianth (below the limb) ferruginous and the perianth-limb tan at anthesis, perianth maturing to red or reddish-pink, perianth-limb remaining ferruginous or tan.

surfaee below the limb in *G. callichlaena* is usually densely subvillous obscuring the epidermis, less often moderately densely subvillous with epidermis slightly visible. In *G. uiqueliaua* the perianth outer surface below the limb is usually loosely subvillous, ± moderately densely subvillous (subsp. *uiqueliaua*), or loosely subtomentose (in subsp. *cincta*), with the epidermis elearly visible. The perianth-limb (just prior to release of style-end) is larger in *G. callichlaeua*, (3.8–) 4.0–4.8 mm wide, compared with 2.5-3.2 mm wide in side-view in *G. uiqueliaua*. The inner surface of the recurved portion of the perianth below the limb in an open flower is uniformly pinkish-red in *G. callichlaeua*, not biehromatie as usually oecurs in *G. uiqueliaua*. The dorsal-tepals are also wider in *G. callichlaeua*, 1.9–2.5 mm wide, compared with 1.2–2.2 mm in *G. uiqueliana*.

Grevillea uiqueliana F.Muell. subsp. ***uiqneliana***

G. victoriae 'race j' of D.J. MeGillivray & R.O. Makinson, *Grevillea*: 321 (1993).

G. uiqueliaua 'Typieal form' of P.M. Olde & N.R. Marriott, *Grevillea Book* 3: 31 (1995).

G. victoriae 'raee j' of R.O. Makinson, *Flora of Victoria* 3: 852 (1996).

Spreading to ereet *shrub* 1.5–3 m high, 1.5–4 m across. *Brauchlets* densely subvillous of biramous non-glandular hairs. epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly aseending hairs with some appressed hairs, straight and wavy hairs, the hairs off-white or silvery-white, with an overlayer of irregularly aligned, predominantly ereet and subereet Y-shaped hairs, straight and wavy hairs, off-white or silvery-white; *internodes* usually distant. *Leaves* ovate to elliptieal to occasionally obovate, (22–) 30–85 mm long, 15–33 mm wide; *uargius* rolled downwards to shortly recurved; *leaf leugth to width ratio* 1.8–3.0:1 (–4.0:1); *leaf upper surface* glabrous and minutely foveolate or asperulous and ± smooth to touch or distinctly granulose and or with longer biramous non-glandular hairs 0.2–0.3 mm high (predominantly in immature leaves) or both, usually glossy, mid to dark-green; *leaf lower* loosely villous of biramous non-glandular hairs, epidermis clearly visible, the hairs irregularly aligned, predominantly ereet and subereet Y-shaped, straight and wavy, off-white or silvery-white with scattered tan-eoloured hairs, with oecasional ferruginous hairs predominantly on the veins, epidermis elearly visible, *lateral veius* eonspicuous to prominent, *reticulum* absent to evident; usually *soft-textured*. *Confloresceuces* simple to twiee-branehed, simple 61.54%, once-branched 34.62%, twiee-branehed 3.84%; *uumber of flowers* (12–) 18–36 (–40) per unit eonflorescence; *priuary peduucles* (0–) 5–12 (–16) mm long, (0.6–) 1.0–1.5 (–1.7) mm wide, indumentum (as in rachises) loosely to densely subvillous or densely tomentose, epidermis not visible or partially visible, of irregularly or mutually aligned, ereet and suberect or predominantly aseending, straight and wavy predominantly Y-shaped hairs, off-white or silvery-white, with or without scattered tan-eoloured and ferruginous hairs, *overall colour* (as in raehises) off-white, dirty-whitish or greenish-white, sometimes the pedunele has a denser indumentum than the rachis (like that of the branehlets); *floral rachises* 22–36 (–42) mm long; *periauth outer surface below the liub* loosely subvillous, epidermis elearly visible, the hairs irregularly aligned, predominantly wavy, predominantly subereet and ereet with seattered irregularly aligned, ascending hairs, the hairs Y-shaped, predominantly ferruginous. (Fig. 1 e.)

Representative specimens examined: **VICTORIA**. Eastern Highlands: Goulbourne [Goulburn] River, 1892, *W.[F.] Gaues* 19 (MEL 65747); Head of the Macalister River, iii. 1861, *F. Mueller s.n.* (MEL 65741); Tangil [Tanjil]. 1895, *C. Collyer* 2 (MEL 65746); Walhalla District, x. 1903, *H.T.N. Tisdall s.n.* (MEL 65750); Walhalla District, vii. 1904, *C. Walter s.n.* (MEL 65744); Tali Karng, 31. xii. 1963, *T.B. Muir* 2961 (MEL 1510168); Valencia Creek Road, 7 km N of Esteppy Yards, ± 16 km SE of Mt Wellington, 1. xi. 1973, *A.C. Beauglehole* 43464 (MEL 517504, NSW); 1.5 km from Walhalla on road to Moe, 20. xi. 1973, *D.J. McGillivray* 3199 & *C. Bartlett* (G, K, MEL 65754, NSW); Barkly-Goulburn State Forest, Morning Star Creek, 25. iv. 1985, *A.C. Beauglehole* 79290

(MEL 673207); Walhalla, 0.6 km S of township on main road S of Walhalla, 24. vi. 1996, *V. Stajsic* 2164-2168 & *P. Wlodarczyk* (AD, CANB, HO, MEL 2115725, 2115727, 2115729, 2115731, 2115733, NSW). Snowfields: At Mount Baw Baw, *s.d., W.H. Pearson s.n.* (MEL 65752); Summit and higher regions of Mt Useful, i. 1863, *F. Mueller s.n.* (MEL 65748); Mount Useful Natural Feature-Scenic Reserve, 24. iv. 1985, *A.C. Beauglehole* 79272 (MEL 673170); Neilson Crag (The Watchtower), c. 7 km E of Snowy Range airport, 1. i. 1987, *D.E. Albrecht* 2976 (MEL 2017447); Moroka River crossing of track from Millers Gap to Moroka Road, 2. i. 1987, *D.E. Albrecht* 2979 (MEL 688976); Mount Useful area, 3 km before summit on Mount Useful Spur Road, 30. viii. 1996, *V. Stajsic* 2404-2407 (AD, CANB, HO, MEL 2115735, 2115737, 2115739, 2115741, NSW); Mount Useful area, 2.5 km before the summit on Mount Useful Spur Road, 31. viii. 1996, *V. Stajsic* 2420 (AD, CANB, HO, MEL 2115745, NSW); Summit of Mount Useful on N side of the firetower, on road between Mount Selma and Mount Useful, 28. ix. 1996, *V. Stajsic* 2421, 2422, *W.M. Molyneux & S.G. Forrester* (AD, CANB, HO, MEL 2115747, 2115750, NSW); Mount Wellington Track, 2.3 km from Tamboritha Road, beside ford at the river crossing, 6. xi. 2002, *P.M. Olde 02/302, P. Madden, D. Fraser & Grevillea Study Group* (BRI, MEL 2233954).

Phenology: Flowering has been recorded almost throughout the year especially at lower altitude sites such as Walhalla. At higher altitudes in the absence of snow flowering can occur sporadically throughout the year. Nectarivorous birds, in particular honeyeaters of various species visit the flowers and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: Grevillea miqueliana subsp. *miqueliana* is endemic to Victoria in the Walhalla, Avon Wilderness, Mt Useful, Caledonia River, and Moroka regions, from low montane to alpine regions of central Gippsland, occurring from 300-1400 m above sea level.

Populations are disjunct, and plants are never common at any site. At some localities, in particular at Walhalla, it is at risk of becoming extinct due to the very small number of plants and landslides. A conservation status of Vulnerable (3VCi *sensu* Briggs & Leigh 1996) or Vulnerable (VU sensu IUCN 2001) is suggested.

Habitat and Ecology: At Walhalla the plants grow on a vertical rocky slope above the road, as well as on a very steep slope below the road, in *Eucalyptus cypellocarpa* and *E. radiata* subsp. *radiata* forest at approximately 300 m above sea level. Along the Mt Useful Spur it is found among granitic boulders and beside the road in a *Eucalyptus kybeanensis* and *E. pauciflora* association. At the summit of Mt Useful it grows in *Eucalyptus pauciflora* woodland, with *Acacia alpina* and *Leionema phylicifolium*, on Tertiary basalts at about 1430 m above sea level. At Neilson Crag it occurs on cliff edges along a narrow ridge, on Ordovician sedimentary rock, in *Eucalyptus glaucescens* woodland, with *Callistemon pallidus, Derwentia perfoliata, Leptospermum brevipes, Nematolepis squamea* subsp. *coriacea, Oxylobium ellipticum* and *Westringia senifolia*, at 1350 m above sea level. At the Moroka River crossing of track from Millers Gap to Moroka Road it grows in tall wet sclerophyll forest dominated by *Eucalyptus delegatensis* and *E. niteus* at approximately 1200 m above sea level.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: An 1892 specimen from the 'Goulbourne River' (MEL 65747) (presumably from near the headwaters of the Goulburn River) and an 1895 specimen from 'Tangil'(MEL 65746) are held at MEL, both collections congruent with *G. miqueliana* subsp. *miqueliana*. MEL also holds another historical specimen of *G. miqueliana* subsp. *miqueliana* collected by W.H. Pearson (no date of collection on the label, MEL 65752),

the specimen labeled as 'At Mt Baw Baw'. This is the only specimen of any member of the *G. victoriae* species complex that is labeled as having been collected from Mt Baw Baw. The locality was either recorded in error, specimens mixed-up or the specimen may have possibly been collected in the Tanjil district or in the vicinity of the headwaters of the Thomson River (see also Notes for *G. parvula*).

There is slight morphological variation present within *G. miqueliana* subsp. *miqueliana*, both intra and inter-populationally. For example, at the summit at Mt Useful there are occasional plants with smaller leaf dimensions in sites that are more exposed to the elements, which approach those of subsp. *moroka* (e.g. V. Stajsic 2405, 2407 & 2420). The leaves of these specimens differ from subsp. *moroka* in being consistently smooth on the upper surface and the margins being rolled or recurved. While the example of the Mt Useful plants can be seen as ecotypic variation, occasional herbarium specimens may sometimes be difficult to assign to subspecies. The Walhalla population tends to have narrower primary peduncles, (0.6–) 0.8–1.0 mm wide compared with other populations of *G. miqueliana* subsp. *miqueliana* which vary from 0.9–1.5 (–1.7), however no other morphological characters could be found to justify the recognition of the Walhalla population as another subspecies of *G. miqueliana*.

The leaves of *G. miqueliana* subsp. *miqueliana* are similar to those of *G. callichlaena*, but the leaf upper surfaces in *G. callichlaena* are consistently granulose.

Grevillea miqueliana* subsp. *cincta Molyneux & Stajsic, *subsp. nov.*

A subspeciebus *miqueliana* et *moroka* ramulis plerumque dense subtomentosis (interdum subvillosis) et lamina infra subsericea vel interdum subtomentosa differt.

Type: Victoria, Eastern Highlands, on a saddle ca. 1 km NE of summit of Mt Selma, and 500 m west of the entrance to Black River Track on the Mt Selma/Fiddlers Green Road, 9. i. 2000, *W.M. Molyneux s.n. & S.G. Forrester* (holo: MEL 2118603!; iso: CANB!, MEL!, NSW!).

Spreading to erect *shrub* 1.5–2.5 m high, 2.5–7 m across. *Branchlets* usually densely subtomentose or occasionally densely subvillous of biramous non-glandular hairs, epidermis not visible, with a lower layer of predominantly mutually aligned, appressed or ascending, straight and wavy hairs, the hairs off-white or silvery-white, with an overlayer of irregularly aligned, predominantly ascending or erect hairs with scattered suberect Y-shaped, straight and wavy hairs, off-white or silvery-white; internodes often distant. *Leaves* narrowly to broadly elliptical, less often obovate, (20–) 40–90 (–102) mm long, (8–) 16–30 (–38) mm wide, usually acute or occasionally obtuse, with a short blunt muero, *margins* rolled downwards to slightly recurved; *leaf length to width ratio* 2.5–3.6:1 (–3.8:1); *leaf upper surface* glabrous and minutely foveolate, usually glossy, mid to dark-green, *lateral veins* obscure or evident, *reticulum* absent; *leaf lower surface* usually loosely to moderately subsericeous or occasionally loosely subtomentose, of biramous non-glandular hairs, epidermis visible, with a lower layer of predominantly mutually aligned appressed hairs, predominantly straight with occasional ± slightly wavy hairs, off-white and silvery-white hairs, if subtomentose with an overlayer of scattered irregularly aligned ascending and subereet, predominantly tan and ferruginous hairs, *lateral veins* conspicuous, *reticulum* evident; *soft-textured*. *Conflorescences* simple to twice branched, simple 67%, once-branched 25%, twice-branched 8%; *number of flowers* (12–) 18–34 (–40) per unit confloreseence; *primary peduncles* (0–) 6–12 (–20) mm long, 0.9–1.1 mm wide, indumentum (as in rachises) subtomentose of biramous non-glandular hairs, epidermis visible or not visible, the hairs predominantly mutually aligned, the hairs appressed and ascending, predominantly straight with occasional ± slightly wavy hairs, the hairs off-white or silvery-white, overall *colour (as in rachises)* off-white, dirty-whitish or

greenish-white, often the peduncle has a denser indumentum (like that of branchlets); *floral rachises* (12–) 17–20 (–28) mm long. (Fig. 1 c.)

Representative specimens examined: **VICTORIA.** Snowfields: Oriental Saddle, 2.4 km ESE from Mount Selma on Track S10, 31. viii. 1996, *V. Stajsic* 2489-2494 (MEL 2185841, 2185842, 2185843, 2185844, 2185845, NSW); Oriental Saddle, 2.4 km ESE from Mount Selma on Track S10, 28. ix. 1996, *V. Stajsic s.n., W.M. Molyneux & S.G. Forrester* (MEL 2185846); Temp Bee Track 124, 1 km NE from summit of Mount Selma, 500 m west from Black River Track entrance, 28. ix. 1996. *V. Stajsic* 2487, 2488, *W.M. Molyneux & S.G. Forrester* (MEL 2185839, 2185840).

Phenology: Flowering has been recorded primarily from July to February, but in the absence of snow can occur sporadically throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: G. miqueliana subsp. *cincta* is endemic to Victoria, in the subalpine region of the central Gippsland highlands, occurring at altitudes between 1200–1400 m above sea level. It is currently only known from two sites in the area between Mt Selma and the Oriental Saddle, N into the headwaters of the Black River and S into the headwaters of Oriental Creek, an area of approximately 2 km^2. The taxon is not protected within any conservation reserve. At the type-site plants occurring beside the road are threatened by road works. At Oriental Saddle it is threatened by roadworks and logging operations as it occurs adjacent to a logging coupe (Stajsic pers. observ. 1996). A conservation status of Endangered (2E *sensu* Briggs & Leigh 1996) or Critically Endangered (CR *sensu* IUCN 2001) is suggested.

Habitat and Ecology At the type-site the plants grow partly along the road in an open position adjacent to a *Eucalyptus pauciflora* and *E. stellulata* dominated woodland, at about 1200 m above sea level. The majority of the population occurs in this woodland on the margin of a moist creek line on a north-facing slope, on soil derived from Ordovician marine sediments (shale and slate). It is associated with *Acacia obliquinervia, Derwentia derwentiana* subsp. *derwentiana, Dianella tasmanica, Monotoca scoparia, Oreomyrrhis* sp., *Poa sieberiana, Pultenaea muelleri,* and *Tasmannia lanceolata*. The abundance of *G. miqueliana* subsp. *cincta* quickly decreases once the understorey of *Calochlaena dubia* and *Polystichum proliferum* increases. At the Oriental Saddle site it grows in tall open forest dominated by *E. dalrympleana, E. delegatensis,* and *E. nitens*.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that a part of both populations occurs along vehicle-tracks, care must be taken not to eliminate these plants through road works.

Etymology: The specific epithet is derived from the Latin '*cinctus*' = 'encircled, 'girdled' or 'enclosed', a reference to its geographic position in relation to *G. miqueliana* subsp. *miqueliana, G. miqueliana* subsp. *moroka, G. monslacana* and *G. victoriae* subsp. *victoriae*.

Notes: Grevillea miqueliana subsp. *cincta* differs from *G. miqueliana* subsp. *miqueliana* and *G. miqueliana* subsp. *moroka* in having usually subtomentose branchlets, and only occasionally being subvillous in some plants at Oriental Saddle (V. Stajsic s.n MEL 2185846). It also differs in having a subsericeous or occasionally subtomentose leaf lower surface of predominantly appressed or slightly ascending hairs. This contrasts with the leaf lower surface indumentum being villous of erect and or suberect predominantly Y-shaped hairs in both *G. miqueliana* subsp. *miqueliana* and *G. miqueliana* subsp. *moroka*. *Grevillea miqueliana* subsp. *cincta* also has consistently smooth leaf upper surfaces that are never granulose.

Grevillea miqueliana* subsp. *moroka Molyneux & Stajsic in Makinson (2000), *Flora of Australia* 17A: 502.

Type: Victoria, The Sentinels, 4 mls [6.4 km] SW of Mt Wellington, 2. i. 1964, *T.B. Muir* 3044 (holo: MEL 1510169!)
G. victoriae 'race k' of D.J. McGillivray & R.O. Makinson, *Grevillea*: 321 (1993).
G. miqueliana 'Mt Wellington form' of P.M. Olde and N.R. Marriott, *Grevillea Book* 3:31-32 (1995).
G. victoriae 'race k' of R.O. Makinson, *Flora of Victoria* 3:852 (1996).

Illustrations: P.M. Olde & N.R. Marriott, *Grevillea Book* 3:31 (bottom right), 32 (20A.) (1995); N.G. Walsh & T.J. Entwisle, *Flora of Victoria* 3: 853 (fig. 172g, h) (1996).

Spreading to erect compact *shrub* (0.5–) 1.5 (–2) m high, 1.2–2.5 m across. *Branchlets* densely subvillous of biramous non-glandular hairs, epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly ascending hairs with some appressed hairs, straight and wavy hairs, the hairs off-white or silvery-white, with an overlayer of irregularly aligned, predominantly erect and subereet Y-shaped, straight and wavy hairs, off-white or silvery-white; internodes often short. *Leaves* elliptical to obovate to occasionally ovate, (9–) 20–35 (–50) mm long, (5–) 8–16 (–25.2) mm wide, apex obtuse or occasionally emarginate with a short blunt mucro, *margins* shortly but distinctly revolute; *leaf length to width ratio* 1.5:1–2.2:1; *leaf upper surface* usually strongly granulose and/or occasionally with scattered longer biramous non-glandular hairs 0.2–0.3 mm long (in younger leaves), seldom only slightly granulose, dull, mid to dark-green; *leaf lower surface* loosely villous of biramous non-glandular hairs, epidermis clearly visible, the hairs irregularly aligned, predominantly erect and subereet Y-shaped, straight and wavy, off-white or silvery-white with scattered tan-coloured hairs, with occasional ferruginous hairs predominantly on the veins, epidermis clearly visible, *lateral veins* prominent, *reticulum* absent to occasionally evident; *leathery-textured. Conflorescence* simple to twice-branched, simple 90%, once-branched 7.5%, twice-branched 2.5%; unit *conflorescence* cylindrical or dome shaped, acropetal; *number of flowers* 22–38 per unit conflorescence; *primary peduncles* (0–) 5 (–17) mm long, (0.8–) 1.0–1.2 (–1.5) mm wide, indumentum (as in rachises) as in branchlets, *overall colour* (as is the rachis) off-white or dirty-whitish; *floral rachises* (5–) 12–20 (–25) mm long. (Fig. 1 c.)

Representative specimens examined: **VICTORIA**. Snowfields: Mt Wellington, iii. 1861, *F. Mueller s.n.* (MEL 65751); Mt Wellington, 25. iv. 1967, *W.M. & J. Molyneux s.n.* (NSW 98771); East Pinnacle Lookout, c. 3 km N of Castle Hill, 13. iii. 1997, *J.A. Jeanes* 265 & *S.A. Day* (MEL 2037429); The Watchtower, c. 8 km E of Mt Reynard, 13. iii. 1997, *J.A. Jeanes* 266 & *S.A. Day* (MEL 2037430); The Pinnacles Fire Tower (overlooking Wonangatta Valley), 12. iii. 1967, *K.C. Rogers s.n.* (MEL 600067); Neilson Crag (The Watchtower), c. 7 km E of Snowy Range airport, 1. i. 1987, *D.E. Albrecht* 2976 & *N.G. Walsh* (MEL 688974); ± 2.8 km NW of Mt Wellington, 7. i. 1973, *A.C. Beauglehole* 41120 & *E.A. Chesterfield* (MEL 2118604 & 559190, NSW); The Razorback between Mount Hump and The Gable End, 30. xii. 1990, *E.A. Chesterfield* 3115 (MEL 2047025); Mount Hump, 11. i. 1949, *T.M. Whaite s.n.* (NSW 93344); Alpine National Park, foot of Neilson Crag (The Watchtower), 15. xii. 2000, *N.G. Walsh* 5271 (MEL 2089859, MEL (Vic.Ref.Set)); Neilson's [Neilson] Crag (The Watchtower), 6. xi. 2002, *P.M. Olde 02/297, P. Madden, D. Fraser & Grevillea Study Group* (BRI, CANB, K, MEL 2233955).

Phenology: Flowering has been recorded primarily between August and January with a second flush in March-April, but in the absence of snow can occur sporadically throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: Grevillea miqueliana subsp. *moroka* is endemic to the alpine region of Victoria occurring at altitudes between 1400 and 1500 m above sea level. It occurs in The Razorback, The Pinnacles, Neilson Crag and the Moroka

River regions. The subspecies occurs within the Alpine National Park. The collecting notes from two recent collections (N.G. Walsh 5271, and P.M. Olde 02/297) from Neilson Crag comment respectively that the subspecies is common or abundant. A conservation status of Vulnerable (2VC- *sensu* Briggs & Leigh 1996) or Vulnerable (VU *sensu* IUCN 2001) is suggested.

Habitat and Ecology: It often grows in high-altitude dry open woodland, usually on rocky sites on ridges and slopes, on stony loam soils. The geology of the sites varies from Upper Devonian to Late Carboniferous sediments to metamorphics. At Neilson Crag *Grevillea miqueliana* subsp. *moroka* grows on cliff edges along a ridge, among scrub on metamorphosed sandstone, and in *Eucalyptus glaucescens* dry open woodland, associated with *Acacia obliquinervia, Acacia siculiformis, Callistemon pallidus, Euryomyrtus ramosissima, Leptospermum brevipes, Nematolepis squamea* subsp. *coriacea, Podolobium ellipticum,* and *Westringia senifolia.* At The Razorback it grows on a rocky exposed escarpment fringed with *Eucalyptus pauciflora* woodland, and at the type locality at The Sentinels it also grows on a rocky outcrop.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Grevillea miqueliana subsp. *moroka* corresponds with McGillivray & Makinson's informal race 'k'. This is a well-known taxon in the horticultural trade where it has been sold under the name *G. miqueliana* 'Mt Wellington' for many years. This taxon was first introduced into the nursery trade by one of us (Molyneux) in 1967 and remains readily available today.

Grevillea miqueliana subsp. *moroka* is most closely related to *G. miqueliana* subsp. *miqueliana.* It can be distinguished from *G. miqueliana* subsp. *miqueliana* by several foliar and floral characters. The most obvious differences between the two subspecies are in the nature of the leaves. *Grevillea m.* subsp. *moroka* usually has rather smaller leaves that are (9–) 20–35 (–50) mm long and (5–) 8-16 (–25) mm wide, which are elliptical to occasionally ovate with strongly revolute margins and usually a granulose leaf upper surface. A single collection from Mt Wellington (MEL 65751) has only slightly granulose leaf upper surfaces, which is unusual especially for the Mt Wellington population. In contrast *G. miqueliana* subsp. *miqueliana* generally has larger leaves, which are (22–) 30–85 mm long and 15-33 mm wide. The leaves are ovate to elliptical or occasionally obovate or narrowly obovate with margins rolled downwards or shortly recurved. The leaf upper surface is usually glabrous and smooth to touch or microscopically asperulous (40x magnification) and smooth to touch in *G. miqueliana* subsp. *miqueliana,* but occasional (possibly immature leaves) specimens such as the A.C. Beauglehole 43464 (MEL 517504) specimen from Valencia Creek Road, 16 km SE from Mt Wellington have granulose leaf upper surfaces. At Walhalla the upper leaf surface is microscopically asperulous (40x magnification) and smooth to touch. The leaf upper surfaces in *G. miqueliana* subsp. *moroka* are almost always granulose. The two subspecies also differ in the length of the floral rachis, G. *miqueliana* subsp. *miqueliana* having relatively longer rachises 22–36 (–42) mm long, compared with (5–) 12–20 (–25) mm long in *G. miqueliana* subsp. *moroka.* There is also a difference in the inflorescence branching between the two subspecies. In *G. miqueliana* subsp. *moroka* the proportion of simple to twice-branched unit-inflorescences is: simple = 90%, once-branched = 7.5%, twice-branched = 2.5%. In *G. miqueliana* subsp. *miqueliana* the proportion of simple to twice-branched unit-inflorescences is: simple = 61.54%, once-branched = 34.62%, twice-branched = 3.84%.

The width of the primary pedunele appears to be a variable character particularly in *G. miqueliana* subsp. *miqueliana* where it varies from being quite slender, (0.6–) 0.8–1.0 mm in the Walhalla population, to as wide as 1.7 mm in some plants in the Mt Useful population, although it is generally 0.9–1.3 mm wide in most populations. The primary pedunele in *G. miqueliana* subsp. *cincta* is 0.9–1.1 mm wide.

From speeimens held at MEL it seems that *Grevillea miqueliana* subsp. *miqueliana* and *G. miqueliana* subsp. *moroka* are sympatrie at Neilson Crag. Two separate eollections with the same colleeting number D. E. Albrecht 2976 & N.G. Walsh and all other label information are held at MEL. MEL 2017447 is eongruent with *G. miqueliana* subsp. *miqueliana*, while MEL 688974 is congruent with *G. miqueliana* subsp. *moroka*. A visit to Neilson Crag in the early 1990's by one of us (Stajsie) observed a single plant of *G. miqueliana* subsp. *miqueliana*, but no voueher speeimen was collected.

Grevillea monslacana Molyneux & Stajsie in Makinson (2000), *Flora of Australia* 17A: 502.

Type: Victoria, Eastern Highlands, Rubieon State Forest, NE junction of Ruoaks Rd and Boundary Trail West, Blue Ra., 10. xii. 1995, *N.H. Simmot 3136* (holo: MEL 2028003!)

G. victoriae 'race h' of D.J. McGillivray & R.O. Makinson, *Grevillea* 321, 324 (1993).

G. victoriae 'Lake Mountain form' of P.M. Olde & N.R. Marriott, *Grevillea Book* 3:225 (1995).

G. victoriae 'race h' of Makinson, *Flora of Victoria* 3:852 (1996).

Spreading to ereet *shrub* (1–) 1.5–3.5 m high, up to 3 m across. *Branchlets* terete, subterete to bieonvex in eross-seetion, with several longitudinal ridges, densely tomentose, epidermis not visible, the hairs mutually and irregularly aligned, the hairs predominantly aseending, predominantly straight or with oeeasional ± slightly wavy hairs, off-white with scattered tan-eoloured hairs, with or without scattered ferruginous hairs. *Colour of new growth* ferruginous, soon beeoming green. *Leaves* aseending (towards apex of shoot), petiolate, simple, entire, narrowly obovate or oecasionally narrowly elliptie, (20–) 30–70 (–120) mm long, (4–) 8–15 (–25) mm wide; apex acute or obtuse with a short blunt muero, *margins* distinetly but not tightly reeurved; *length to width ratio* (3.6:1–) 4.0–6.0:1 (–8.0:1); *leaf upper surface* glabrous and minutely foveolate, or with seattered biramous non-glandular, mutually aligned, appressed, ascending and or ± ereet silvery-white hairs (0.1–) 0.3 mm long just above petiole on the midvein and sides of the midvein on the lamina, variably dull or glossy, mid to dark-green. *lateral veins* obscure to evident, rarely conspicuous, *reticulum* absent; *leaf lower surface* looscly serieeous of biramous non-glandular hairs, epidermis elearly visible, the hairs predominantly mutually aligned, appressed, straight, short, silvery-white, with oceasional regularly and irregularly aligned, tan-coloured and ferruginous hairs, *lateral veins* obscure to evident, retieulum absent; soft and relatively thin textured. *Conflorescences* terminal or occasionally axillary or cauline, decurved to pendulous, pedunculate, simple to four- branehed, simple 42%, onee-branched 28%, twiee-branehed 19%, thriee-branehed 7%, four-branehed 4%, *unit conflorescence* ovoid or a loose sometimes subseeund eluster, aeropetal, *number of flowers* (8–) 20–24 (–34) per unit conflorescence; *primary peduncles* (0–) 4–10 (–25) mm long, (0.8–) 1 (–1.2) mm wide, indumentum (as in raehises) tomentose of biramous non-glandular hairs, epidermis not visible or ± partially visible, predominantly ascending with oeeasional subereet hairs, straight with oceasional ± slightly wavy hairs, off-white or silvery-white, with or without occasional ferruginous hairs, *overall peduncle colour* whitish (as in rachises); *floral rachises* (10–) 15–30 (–35) mm long; *floral bracts* narrowly-triangular, linear-ereseentie in side-view, basally truneate, apex aeute but blunt-tipped, 1.0–1.5 (–2.0) mm long and 0.3–0.5 mm wide, outer surfaee densely subserieeous

of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight and slightly wavy, off-white with occasional tan-coloured hairs, with scattered, predominantly mutually aligned slightly ascending hairs particularly at apex, glabrous inside except just below apex, brown, persistent until buds ca. 0.8–1.0 mm long; *pedicels* (3.0–) 3.5–4.5 (–5) mm long; *torus* oblique at 15–25° angle to the pedicel, squarish in plane-view with rounded angles; *very early flower buds* wholly apricot-coloured or light-ferruginous, or perianth (below the limb) apricot-coloured, maturing to red, pink or creamish, limb brownish-grey and maturing to brownish-grey or apricot-coloured, *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* squarish with rounded edges in cross section; *perianth outer surface below the limb* loosely subsericeous of biramous non-glandular hairs, epidermis clearly visible, the hairs predominantly mutually aligned, predominantly appressed, straight and slightly wavy, ferruginous and tan-coloured, with scattered irregularly aligned, appressed and or ascending hairs, pink, pinkish-red or rarely whitish or pink with a white blotch in the central portion of ventral tepals; *perianth inner surface below the limb epidermis* minutely papillate below beard, glabrous except for beard, pinkish-white or whitish coloured; *perianth-limb* subglobose in side-view, squarish with rounded angles face on, apex obtuse, limb-segments not keeled on outer surface, rarely obscurely midline-keeled on outer surface, indumentum densely subsericeous of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed, straight and slightly wavy, off-white and tan-coloured, with scattered irregularly aligned, appressed and slightly ascending hairs, epidermis pink or pinkish-red; *dorsal tepal beard* commencing (2.8–) 3.2–3.5 mm above toral rim, beard extending for (3.7–) 4.2–5.7 mm, hairs 1.2–1.5 (–1.7) mm long; *ventral tepal beard* commencing 4.0–6.0 mm above toral rim, beard extending for (1.5–) 2.5–2.8 (–3.7) mm, hairs 1.2–1.5 (–1.7) mm long; *dorsal tepals* (17–) 18–20 (–21.5) mm long, 2.0–2.2 mm wide; *nectary* crescentic, 3/4 annular, projecting 0.2–0.3 mm above toral rim, margin entire or tridentate, pale-yellow; *pistil* (16–) 18–20 (–23) mm long; *stipe* (1.0–) 1.2–1.8 (–2.5) mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth before release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs in the upper 1/2 to upper 3/4 of style length, particularly at back of the style-end, pink, reddish-pink or rarely whitish; *pollen-presenter* strongly oblique to style, 2.0–2.5 (–2.7) mm long, 1.6–2.1 mm wide; *face of pollen-presenter* convex in cross-section, base not concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, 18–22 mm long, 5–7 mm deep, wall 0.5–0.9 mm thick, glabrous, faintly colliculose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1 d.)

Representative specimens examined: **VICTORIA**. Eastern Highlands: Lake Mountain, xi. 1926, *ipse legi* (MEL 75128); Keppel Falls, ix. 1927, *Miss Goldsworthy* s.n. (MEL 75121); Marysville, 1928, *M. Keppel* s.n. (MEL 75167); Lake Mountain, i. 1929, *P.F. Morris* (MEL 75122); Forests Commission Huts, on one of the heads of Taggerty River, Lake Mountain, 10 miles N.E. of Marysville, 25. i. 1948, *J.H. Willis* s.n. (MEL 75169); Lake Mountain, 26. i. 1948, *J.H. Willis* s.n. (MEL 75153); Mt Margaret Road, along Whitehouse Creek, Blue Range, 26. ix. 1964, *R. Filson* 6522 (MEL 648229); Sources of Whitehouse Ck, between Mt Margaret and Keppel's Hut, (Lake Mountain area, ca. 90 miles ENE of Melbourne), 24. ix. 1964, *J.H. Willis* s.n. (MEL 75130); Lake Mountain, 8. iv. 1973, *M.D. Tindale* 763 (CANB, K, NSW 450205); Gerratys area, Lake Mountain, 17. xii. 1981, *N.G. Walsh* 907 (MEL 628623); Lake Mountain State Park, Melbourne Study Area, Sector H, Sub-Block 41A, 23. xi. 1982, *A.C. Beauglehole* 71693 & *C.M. Beardsell* (MEL 236985); Lake Mountain, 15. x. 1985, *D.B. Foreman* 1044 & *R. Filson* (CANB, MEL 1546270, NSW); Lake Mountain Region, ca. 3 km NNE of summit on track to Mt Bullfight, 13. ii. 1993, *D.E. Albrecht* 5238, *I.C. Clarke* & *V. Stajsic* (MEL 2017356); Lake Mountain area, Gerratys carpark site, 10. vi. 1996, *V. Stajsic* 2144 & *W.M. Molyneux* (AD, CANB, MEL 2114536, NSW); Marysville State Forest, corner of Upper Taggerty Road, Goulds and Goulds No.2 Tracks, 10. vi. 1996, *V. Stajsic* 2400 & *W.M. Molyneux* (AD, CANB, HO, MEL 2114539, NSW); Marysville State Forest, 1 km

SE from Goulds No.1 Track on Upper Taggerty Road, on E side of Upper Taggerty River, 10. vi. 1996, *V. Stajsic* 2403 & *W.M. Molyneux* (AD, CANB, HO, MEL 2114533, NSW); Marysville State Forest, E side of Boundary Trail West Road, 0.38 km NW of its junction with Keppels Hut Track, 6. xii. 1998, *W.M. Molyneux s.n. & S.G. Forrester* (AD, CANB, HO, MEL 2061360, NSW).

Phenology: Flowering has been recorded primarily between August and January, but in the absence of snow can occur sporadically throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: Grevillea monslacana is endemic to Victoria occurring in a geographically restricted area to the north and northeast of Marysville, in the Mt Margaret and Lake Mountain region. It is the most westerly occurring species in the complex. The species is represented within Marysville State Forest and in the Lake Mountain area, where it occurs in scattered populations. Long-term fire regimes may be significant in local populations (see below). A conservation status of Rare (2RC- *sensu* Briggs & Leigh 1996) or Near Threatened (NT *sensu* IUCN 2001) is suggested.

Habitat and Ecology: Grevillea monslacana occurs in montane wet sclerophyll forest and subalpine open woodland, between 1100 and 1400 m above seal level. In the Marysville State Forest at the Upper Taggerty Road site it is found commonly beside roadsides as well as extending into the bushland. These sites are located at approximately 1100 m altitude, on chocolate-coloured soils of Palaeozoic granitic derivation, in *Eucalyptus delegatensis* dominated forest.

At Gerratys (i.e. Lake Mountain car-park area) *G. monslacana* grows on road batters, and extends into the bushland. This site is perhaps more subalpine than montane and the dominant overstorey species at this site are *Eucalyptus delegatensis* and *Eucalyptus pauciflora* subsp. *pauciflora*.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Willis (1973) treated the population from near the head of the Taggerty River in the Eastern Highlands region of Victoria as part of *G. victoriae* var. *leptoneura*, but for an unknown reason placed the Lake Mountain populations into *G. victoriae* var. *victoriae*. Both the Taggerty and the Lake Mountain populations are congruent with *G. monslacana*. *Grevillea monslacana* corresponds with the informal race 'h' of McGillivray & Makinson (1993), the 'Lake Mountain form' of Olde & Marriott (1995), and race 'h' of Makinson (1996).

Grevillea monslacana exhibits little morphological variation, with minor variation in leaf size and shape, and flower colour.

The leaf lower surface of *G. monslacana*, like that of *G. epicroca*, is loosely sericeous of mutually aligned, short, silvery-white hairs. This distinguishes both *G. monslacana* and *G. epicroca* from *G. bemboka*, *G. brevifolia*, *G. oxyantha*, most populations of *G. parvula*, *G. polychroma* and *G. victoriae*, all of which have a densely sericeous or subsericeous leaf lower surface.

Grevillea monslacana differs from *G. epicroca* in having densely tomentose, terete, subterete or biconvex branchlets in cross-section, compared to the loosely sericeous, distinctly angular or subangular branchlets in *G. epicroca*. *Grevillea monslacana* also differs from *G. epicroca* and *G. parvula* in having the face of the pollen-presenter oblique to the style and convex (or occasionally flat) in cross-section, in contrast to the pollen-presenter being lateral to the style and concave in cross-section in *G. epicroca* and *G. parvula* (seldom flat in some flowers on occasional plants of *G. parvula* at Towamba River).

Grevillea polychroma differs from *G. monslacana* in the branchlets being sericeous or subsericeous, the leaf lower surface usually densely sericeous or subsericeous, with the epidermis not visible or partially visible, and the pollen-presenter lateral to the style. The leaf length to width ratio is also lower in *G. polychroma*, (2.0:1–) 2.3–3.0:1 (–4.3:1), compared with (3.6:1–) 4.0–6.0:1 (–8.0:1) in *G. monslacana*.

Grevillea parvula Molyneux & Stajsic in Makinson (2000), *Flora of Australia* 17A: 502.

G. victoriae var. *leptoneura* Benth., *Fl. Austral.* 5: 468 (1870), as var. ? *leptoneura*.

Type: [Victoria] Sources of the Genoa River, *F. Mueller s.n.* recd 1870 (lecto: K–specimen to the left of the sheet, Neg.No.Kew 2285 *n.v.*, (*fide* D.J. McGillivray & R.O. Makinson, *Grevillea*: 447-448 (1993)); isolecto: [collection data as for lectotype] (K–specimen to the right of the sheet Neg.No.Kew 2285); residual syntypes: Sources of the River Genoa, N.S.W., *s.d.*, *ipse legi* [*F. Mueller*], also labeled: On the gravelly [*sic*] banks of creeks between the Womboyn & Genoa Rivers (MEL 75160 incl.pkt.!); White rock mountain 3–4000', Sept. 1860, *ferd. Mueller* (MEL 75161 incl.pkt.!).

G. victoriae F.Muell. 'race f' *p.p.*, of D.J. McGillivray & R.O. Makinson, *Grevillea*: 321 (1993).

G. victoriae F.Muell. var. *leptoneura* Benth. of P.M. Olde and N.R. Marriott, *Grevillea* Book 3: 224-225, (1995).

G. victoriae F.Muell., unassigned to race *p.p.* ('Mallacoota Inlet'), of R.O. Makinson, *Flora of Victoria* 3: 852 (1996).

Illustrations: J.W. Wrigley & M. Fagg, *Banksias, Waratahs & Grevilleas*: 332 (1991), as *G. victoriae* var. *leptoneura;* D.J. McGillivray & R.O. Makinson, *Grevillea*: 323 (1993), as *G. victoriae.*
P.M. Olde & N.R. Marriott, *Grevillea Book* 3: 225 (184G.) (1995), as *G. victoriae* var. *leptoneura.*

Spreading to erect *shrub* (0.5–) 1–2 (–3) m high, 1–3 m across. *Branchlets* terete, subterete, concavo-convex or plano-convex in cross-section, seldom subangular in cross-section, with several longitudinal ridges, densely subvillous or seldom tomentose (some plants collections from Mt Wog Wog), of biramous non-glandular hairs, epidermis not visible, with a lower layer of mutually aligned and irregularly aligned, predominantly ascending hairs with some appressed, straight and wavy hairs, the hairs off-white or silvery-white and tan-coloured, with an overlayer of irregularly aligned, predominantly erect and suberect Y-shaped, straight and wavy hairs, off-white or silvery-white with occasional ferruginous hairs. *Colour of new growth* usually pink or purplish-pink, occasionally green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, narrowly elliptical, oblanceolate to narrowly obovate rarely broad obovate (in some plants in the Mt Wog Wog population), (12–) 25–50 (–80) mm long, (4–) 8–15 (–19) mm wide, apex usually acute with a short blunt mucro or obtuse with or without a short blunt mucro, margins very shortly recurved; *leaf length to width ratio* 2.0–5.0:1; *leaf upper surface* glabrous, minutely foveolate, or occasionally with scattered biramous non-glandular, appressed and/or ascending irregularly aligned, silvery-white hairs mostly just above the petiole, dull (? seldom glossy), mid-green to dark green, *lateral veins* obscure or rarely evident, *reticulum* obscure; *leaf lower surface* usually moderately densely or occasionally loosely subsericeous or subtomentose of biramous non-glandular hairs, the epidermis not visible, partially visible, or clearly visible, the hairs predominantly mutually aligned, predominantly appressed or predominantly aseending, straight with occasional ± slightly wavy hairs, silvery-white, with occasional or scattered ferruginous, dark ferruginous and or tan-coloured hairs, *lateral veins* obscure or occasionally evident, *reticulum* obscure; *soft-textured* (*? seldom leathery*). *Conflorescences* terminal or axillary, rarely subcauline, decurved to pendulous, pedunculate, simple to thrice-branched, simple

83%, once-branched, 11.45%, twice-branched 5%, thrice-branched 0.55%, *unit conflorescence* a loose irregular occasionally subsecund cluster, cylindrical or domed, acropetal; *number of flowers* (10–) 18–30 (–36) per unit conflorescence; *primary peduncles* (0–) 5–15 (–18) mm long, 0.6–1.0 mm wide, indumentum (as in raehises) moderately densely subsericeous or subtomentose of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed and ascending, straight and ± slightly wavy hairs, silvery-white hairs with scattered mutually and irregularly aligned, scattered overlying tan-coloured or ferruginous hairs, or sometimes subvillous (and rachis tomentose), the hairs irregularly aligned, predominantly subercct with scattered ascending hairs, straight and wavy hairs, off-white and tan-coloured, *overall colour (as in rachises)* greenish, greenish-grey, off-white or whitish; *floral rachises* (6–) 10–20 (–35) mm long; *floral bracts* narrowly-triangular, linear-ereseentie in side-view, basally truncate, apex acute but blunt-tipped, 0.9–1.2 mm long, 0.2–0.3 mm wide, outer surface indumentum densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed with occasional ascending hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white with tan-coloured hairs at the apex, inner surface glabrous except for the upper 1/3–1/4 of bract length, brown, persistent until buds 0.8 mm long; *pedicels* 2.5–5 mm long; *torus* oblique to pedicel at (10°) 15–40° squarish in plane-view with rounded angles; *very early flower buds* wholly reddish-purple, perianth below the limb maturing to red or pinkish-red, limb maturing to ferruginous; *advanced buds (pre-anthesis)* acroscopic, maturing to ± aeroseopic to variably retrorse; *perianth below the limb* squarish in cross-section; *perianth outer surface below the limb* moderately densely to loosely subsericeous or subtomentose, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed with scattered ascending, straight with occasional ± slightly wavy hairs, ferruginous and tan-coloured, base of perianth occasionally with minute, spreading simple glandular hairs (evident only in fresh or spirit preserved flowers), epidermis visible, epidermis red, overall perianth colour red or reddish-pink; *perianth inner surface below the limb epidermis* minutely papillate below beard, glabrous except for beard, red or pinkish-red; *perianth-limb* subglobose in side-view, squarish with rounded angles face-on, apex obtuse, limb-segments not keeled on outer surface, rarely obscurely midline-keeled on outer surface, densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs mutually aligned, predominantly appressed with occasional slightly ascending hairs, predominantly straight with occasional ± slightly wavy hairs, ferruginous, epidermis red; *dorsal tepal beard* commencing (0.8–) 1.8–2.5 (–3.5) mm above toral rim, beard extending for (2.0–) 4.0–6.2 mm, hairs (1.0–) 1.2–1.3 mm long; *ventral tepal beard* commencing 4–6.5 mm above toral rim, beard extending for 1–3.2 mm, hairs (0.8–) 0.9–1.0 (–1.2) mm long; *dorsal tepals* (11.2–)17–20 mm long, 1–1.8 (–2.0) mm wide; *nectary* generally U-shaped or half-annular, projecting 0.1–0.5 mm above the toral rim, margin entire, pale-yellow; *pistil* (11–) 17–20 mm long; *stipe* (1.0–) 1.5–2.0 (3–) mm long, glabrous; ovary glabrous, green; *style* exserted from dorsal suture of perianth before release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs over most of style length or hairs confined to the upper 1/4–1/2 or 3/4 of style length, particularly at back of style-end, red or reddish-pink; *pollen-presenter* lateral to style, 1.5–3 mm long, 0.9–2.6 mm wide; *face of pollen-presenter* concave in cross-section (seldom ± flattened in occasional flowers in some plants in the Towamba River population), base concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, (14.5–)17–19.5 mm long, wall 0.5–0.6 mm thick, glabrous, faintly cellulose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1 c.)

Representative specimens examined: **NEW SOUTH WALES.** South Coast: Towamba, W of Eden, vi. 1933, *B. Pigott s.n.* (NSW 93315); 8 m. W of Pericoe, WSW of Eden, *A. Floyd* 8 (NSW 93309); Track to Mt Imlay, c. 20 km SW of Eden, 15. x. 1974, *R. Coveny* 5800 & *J. Armstrong* (B,

K, L, MEL 75134, NA, NSW 450212, NT, PERTH, RSA); Letts Mountain, ca. 36 km W of Eden, 7 km ESE of Mt Wog Wog, 24. x. 1977, *I.R. Telford* 6741 (CANB, NSW 450194); 2 km S along Yambulla Road from Eden-Bombala Road, 26. iv. 1984, *K. Hill* 728, L.*[A..S.] Johnson & L. Pryor* (NSW 450209); Upper Genoa River, Limestone caves c. 1 km upstream from the confluence of Genoa and Nungatta Creek, 6. iv. 1986, *D.E. Albrecht* 2585 (MEL 690250); Yambulla State Forest, mountain peak 2.5 km direct NE of Mt. Poole, 21. vii. 1986, *J.D. Briggs* & *D.E. Albrecht* 1999 (CANB, NSW 450192); Coolangubra State Forest, southern escarpment of Big Jack Mountain, overlooking Stockyard Creek, 21. x. 1986, *D.E. Albrecht* 2926 (MEL 688943); Stanley Creek, near the intersection of Yambulla Road and Water Race Road, 14. iv. 1990, *D.E. Albrecht* 3931 (MEL 580850); Timbillica State Forest, ford of Wallagaraugh River near N end of Gallery Forest Road, 22. xi. 1992, *R.O. Makinson* 1236 & *G. Butler* (CBG, MEL 713942); South East National Park, Nalbaugh Plateau, Wog Wog Trig, 11. xi. 1999, *B.J. Mole* 311 & *W.A. Gebert* (MEL 2145914); Yambulla State Forest, near bridge of Imlay Road, 10. ix. 1996, *V. Stajsic* 2424-2426 (AD, CANB, HO, MEL 2115753, 2115755, 2115757, NSW); Mount Imlay National Park, Towamba River, 15.2 km from Princes Highway on Kiah-Towamba Road, 14. xi. 1996, *V. Stajsic* 2445 (CANB, MEL 2116283, NSW); East Compartment 249, crossing of Wallagaraugh River, reached from Broadaxe Road off princes Highway via German Creek Road, 21. xi. 1997, *W.M. Molyneux s.n.* & *S.G. Forrester* (MEL 2061359); **VICTORIA**. East Gippsland: Nungatta Mountains, 1869, *W. Weatherhead s.n.* (MEL 75162); Mallacoota, xi. 1925, *C.L. Barrett s.n.* (MEL 688391); Upper Genoa River, 25. ix. 1948, *N.A. Wakefield* 3199 (MEL 1510404); Back Creek, Mt Kaye, 13. x. 1948, *N.A. Wakefield* 3632 (MEL 1510180); Norinbee District, Camferbar Road, 3.3 km N of Thurra Junction Road, 24. v. 1980, *D.A. Cooke* 281 (MEL 566563); 200 m above Tennyson Creek, 0.7 km upstream from confluence with Sunday Creek, 11. iii. 1986, *J.V. Yngovic* 267 & *I.D. Lunt* (MEL 685232); Bank of Genoa River, beside Wangarabell Road, 19.3 km from Princes Highway, 24. x. 1991, *N.G. Walsh* 3239 (BRI, CANB, MEL 2013494, NSW); Coopracambra National Park, bank of Genoa River, 0.5 km due S of its confluence with Yambulla Creek, 20. i. 2000, *N.G. Walsh* 5144 (MEL 2063310).

Phenology: Flowering has been recorded throughout the year. At higher elevations such as at Mt Wog Wog snow may affect the seasonality of flowering time. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it is assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: In New South Wales *G. parvula* occurs predominantly to the south and west-southwest of Eden, in an area bounded by Eden on the coast, Pericoe to the west, and extending southwest to Yambulla State Forest and Rockton. In Victoria its distribution is centred on the Wallagaraugh and the Genoa Rivers but extends west to the Tennyson/Sunday Creeks (part of the Cann River system) area c.10 km northwest from Buldah just south of the New South Wales/Victoria border. *Grevillea parvula* occurs as scattered, localised populations in New South Wales and Victoria. It is more common in New South Wales where it is represented in some conservation reserves such as Mt Imlay National Park, and Nalbaugh National Park. The population at the lower Wallagaraugh River above Gipsy Point on the Mallacoota lakes in far eastern Victoria is currently not known to be under threat and appears to be represented within the Croajingolong National Park. The Mt Kaye population is represented in the Coopracambra National Park. However, the population near Buldah ca. 40 km north of Cann River, on the west side of the Monaro Highway, which is the most westerly population of the species in Victoria, occurs within State Forest. A conservation status of Rare (3RC- *sensu* Briggs & Leigh 1996) or Near Threatened (NT *sensu* IUCN 2001) is suggested for the New South Wales populations. For the Victorian populations a conservation status of Vulnerable (2VC- *sensu* Briggs & Leigh 1996) or Vulnerable (VU *sensu* IUCN 2001) is suggested.

Habitat and Ecology: Grevillea parvula has the broadest altitudinal range in the *G. victoriae* species complex. At an isthmus in the upper Mallacoota area on the Wallagaraugh River it can be found growing in almost saline conditions among *Melaleuca armillaris*. The species is not uncommon along the banks of the Wallagaraugh

River and the Genoa River. At Stanley Creek in the South Coast region of New South Wales it grows in crevices between granite rocks in riparian forest with *Eucalyptus elata*, *Lophostemon confertus*, *Leptospermum scoparium* and *Babingtonia pluriflora*. On the Towamba Road between Kiah and Towamba in the Imlay National Park *G. parvula* grows on road batter at an elevation of about 50 m in tall forest, as well as on the slopes above the Towamba River. At another site at the Imlay Road crossing of the Imlay Creek *G. parvula* grows among the boulder strewn slopes above the creek in dry-sclerophyll woodland with an overstorey of *Eucalyptus consideniana* and *Allocasuarina littoralis*. At Mt Imlay it grows in *Eucalyptus sieberi* forest. Mt Wog Wog is the highest elevation at which *G. parvula* has been recorded, at 1139 m above sea level.

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Grevillea parvula corresponds with *G. victoriae* var. *leptoneura* Benth. *sens. strict.* only, and corresponds with McGillivray & Makinson's informal race 'f' only in part. It corresponds again only in part with the concept of var. *leptoneura* sensu by Olde and Marriott (1995), as these authors excluded the Mt Kaye populations (*G. parvula*) from their concept of *G. victoriae* var. *leptoneura*. However, unlike McGillivray & Makinson (1993), they did not include the W Tree Creek and the Mt Elizabeth populations within their concept of *G. victoriae* var. *leptoneura*, these taxa belonging in *G. polyclinoma*.

The name *G. victoriae* var. *leptoneura* is well known both among the botanical fraternity, as well as among the horticultural industry where it is sometimes referred to as *G. victoriae* var. '*tenuinervis*.' *G. victoriae* var. '*tenuinervis*' is a latinised form of the epithet *leptoneura* and has no formal nomenclatural status except perhaps as a *nomen nudum* (McGillivray & Makinson 1993).

Since the publication of *Grevillea victoriae* var. *leptoneura* by Bentham (1870), the name has been applied with varying degrees of consistency to a range of populations in Victoria, and the area between Eden in New South Wales and the Victorian border that have a combination of thin leaves, a sparser leaf lower surface indumentum and smaller floral features than present in the other populations of *G. victoriae sens. strict.* All are clearly very closely related but differ from one another in either strong or subtle vegetative and floral attributes. Willis (1973) treated the populations from the Taggerty, Thomson, Cann, Genoa and the Wallagaraugh Rivers as all belonging to *G. victoriae* var. *leptoneura*. The first of these populations corresponds with *G. monslacana*. No specimens from the Thompson River area are held at CANB, MEL or NSW herbaria. One can therefore merely speculate as to the identity of Thompson River taxon, it may belong to *Grevillea miqueliana* subsp. *miqueliana* (see also Notes for *G. miqueliana* subsp. *miqueliana*).

The Back Creek population of *G. parvula* in the Cann River district was treated by Willis (1973) as part of *G. miqueliana*. McGillivray & Makinson (1993) in their delineation of the informal races delimited race 'f' which was an even more heterogeneous assemblage that included the populations from W Tree Creek and Mt Elizabeth within race 'f'. Olde and Marriott (1995) however, appear to be the first workers to treat the populations from the W- Tree Creek and Mt Elizabeth as representing a distinct taxon separate from *G. victoriae* var. *leptoneura*. However, the Mt Kaye population that belongs to *G. parvula* should not have been excluded from their concept of *G. victoriae* var. *leptoneura*. While these three populations do not constitute one taxon,

what is significant is that the segregation by Olde and Marriott of these three populations, in particular the W Tree Creek and the Mt Elizabeth populations, represented an important step towards an elucidation of the *G. victoriae* var. *leptoneura* amalgam and the formation of a concept of *G. polychroma*.

In Makinson (2000) we restricted the concept of *G. victoriae* var. *leptoneura* to those populations of McGillivray & Makinson's race 'f' in part, that lie in New South Wales and in Victoria, on the catchment of the Wallagaraugh and Genoa Rivers (i.e. those mapped as east of 149° longitude in McGillivray & Makinson (1993): 322, map 90)).

The lectotype of *G. victoriae* var. *leptoneura* was collected by F. Mueller at the 'sources of the Genoa River' (probably near White Rock Mountain in the South Coast region of New South Wales) in 1870.

Due to the history of broad/loose application of the name *G. victoriae* var. *leptoneura* to several discrete taxa which we described in Makinson (2000) (i.e. *G. brevifolia* subsp. *polychroma*, *G. epicroca* and *G. monslacana*) we renamed *G. victoriae* var. *leptoneura* as *G. parvula*.

G. parvula often has smaller leaves, flowers and follicles compared to some of its close relatives.

G. parvula has affinities with *G. epicroca* which differs in having angular or subangular branchlets in cross-section, which are sericeous, loosely sericeous or have scattered, mutually aligned, appressed, silvery-white hairs. The branchlets in *G. parvula* are terete, subterete, concavo-convex or plano-convex in cross-section, seldom subangular, and densely subvillous (seldom tomentose). *G. epicroca* has a loosely sericeous or sparse indumentum of scattered short appressed hairs on the leaf lower surface which differentiates it from most populations of *G. parvula*. Occasional specimens of *G. parvula* from the Upper Genoa River (MEL 1510404) and a single collection from near the confluence of Tennyson and Sunday Creeks (MEL 685232) (both sites located in the East Gippsland region of Victoria) have a rather loosely sericeous leaf lower surface, but the hairs are longer than those of *G. epicroca*.

G. parvula differs from *G. polychroma* in having subvillous (seldom subtomentose as in occasional specimens from Mt Wog Wog) rather than subsericeous or subtomentose branchlets. The new growth in *G. polychroma* is ferruginous, not pink or purplish-pink (seldom green) as in *G. parvula*. The leaf upper surface in *G. polychroma* is glossy, not dull as in *G. parvula*. The very early flower buds in *G. polychroma* are wholly ferruginous or tan, not wholly reddish-purple as in *G. parvula*. The overall colour of the perianth outer surface below the limb in *G. polychroma* varies from red, pink, orange, yellowish to cream, compared with red or pinkish-red in *G. parvula*. The pollen-presenter is lateral and concurrent in both species, but in *G. polychroma* the face of the pollen-presenter is flat (or the lower margins incurved giving an appearance of being slightly concave as in some plants in the Mt Elizabeth population), not distinctly concave as in *G. parvula* (seldom flat as in occasional flowers on some plants at Towamba River).

A number of collections (*Olsen* s.n. NSW 128904; *M.D. Crisp* 2389, *D.J. Cummings & A. Tyrrel* NSW 452938; *D.J. Cummings* 41, *M.D. Crisp & A. Tyrrel* NSW 450183; *D.J. Cummings* 42, *M.D. Crisp & A. Tyrrel* NSW 450181) east of Big Badja at the southern extension of the Minuma Range in the Southern Tablelands escarpment of New South Wales appear to be similar to *G. parvula*. These collections are congruent with the 'unassigned specimen 4' of McGillivray & Makinson (1993). These collections share some points of similarity between *G. bemboka*, *G. parvula* and *G. epicroca*. The specimens have obovate or narrow-obovate leaves, 25-65 mm long x 8-20 mm wide, the leaf upper surface venation is obscure or evident, the leaf lower surface is subsericeous, the perianth-limb obtuse and slightly keeled. They are here treated as unassigned. See also Notes section for *G. bemboka*.

Grevillea polychroma (Molyneux & Stajsic) Molyneux & Stajsic *comb. et stat. nov.*

Grevillea brevifolia F.Muell. ex Benth. subsp. *polychroma* Molyneux & Stajsic in Makinson (2000), *Flora of Australia* 17A: 502.

Type: Betts Creek Track, 12 [1.2] km E of Tulloch Ard Road, 9.5 km E of Mt Murrindal, Victoria, 9. ii. 1980, *S.J. Forbes* 264 (holo: MEL 594978!; iso: NSW!)

G. victoriae F.Muell. 'race f' *p.p.* of D.J. McGillivray & R.O. Makinson, *Grevillea*: 321 & 322 (1993).

G. victoriae F.Muell. 'race f' (Victorian populations only) of R.O. Makinson, *Flora of Victoria* 3: 852 (1996).

Spreading to erect open *shrub* 1–3 m high, to 5 m across; *branchlets* subangular becoming terete, with several longitudinal ridges, densely subsericeous or subtomentose of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, predominantly appressed, with scattered mutually aligned and irregularly aligned slightly ascending hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white. *Colour of new growth* ferruginous soon becoming green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, usually obovate, less often elliptical or narrowly elliptical, (11–) 33–68 (–70) mm long, (6–) 12–23.5 (–30.5) mm wide, apex acute with a short blunt muero, or occasionally obtuse; *margins* tightly and shortly recurved; *leaf length to width ratio* (2.0:1–) 2.3–3.0:1 (–4.3:1); *leaf upper surface* glabrous and minutely foveolate, except for scattered hairs on midvein just above petiole, glossy, mid-green, *lateral veins* obscure or evident, *reticulum* absent; *leaf lower surface* moderately densely sericeous of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed with occasional irregularly aligned, appressed hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white, with or without occasional irregularly aligned often overlying tan-coloured and or ferruginous hairs, *lateral veins* evident or obscure, *reticulum* obscure or absent; thin-textured. *Conflorescences* terminal or subterminal, decurved to pendulous, pedunculate, simple to thrice-branched, simple 69%, once-branched 26%, twice-branched 4%, thrice-branched 1%, *unit conflorescence* a loose subregular cluster, acropetal; *number of flowers* (12–) 28 (–44) per unit conflorescence; *primary peduncles* (0–) 6–15 (–21) mm long, 0.8–1.0 mm wide, indumentum (as in rachises) usually moderately densely subsericeous, epidermis not visible or partially visible, the hairs predominantly mutually aligned, predominantly appressed with occasional mutually aligned and irregularly aligned appressed and ascending silvery-white/off-white tan-coloured and ferruginous hairs, overall colour (as in rachises) whitish or greenish-white; *floral rachises* (11–) 14–20 (–32) mm long; *floral bracts* narrowly-triangular, linear-crescentic in side-view, basally truncate, apex acute but blunt-tipped, 1.5–2.0 mm long, 0.4–0.5 mm wide, outer surface densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, predominantly appressed, straight and slightly wavy hairs, off-white and ferruginous with scattered irregularly aligned, ascending, tan-coloured and ferruginous hairs, inner surface glabrous except in upper 1/4 of bract length, persistent until buds 0.8-1.0 mm long; *pedicels* 2.8–7 mm long; *torus* oblique at 20–35°, squarish in plane-view with rounded angles or roundish; *very early flower buds* wholly ferruginous or tan-coloured, perianth below the limb maturing to creamish, pale-yellow, pink, pinkish-red or red, limb maturing to tan-coloured or light-ferruginous; *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth outer surface below the limb* moderately densely subsericeous or ± subtomentose of biramous non-glandular hairs, epidermis visible, the hairs predominantly mutually aligned, predominantly appressed with scattered irregularly aligned, appressed and ascending hairs, predominantly straight with occasional ± slightly wavy hairs, ferruginous and tan-coloured, epidermis red, pink, orange, yellowish or cream, overall perianth colour red, pink, orange, yellowish or cream;

perianth inner surface epidermis below the limb usually minutely papillate below beard, papillae particularly conspicuous along tepal margins where they are often larger and form minute simple hairs, glabrous except for beard, red, pink, orange, yellow or cream; *perianth-limb* subglobose in side-view, squarish in plane-view with rounded angles, apex obtuse, limb-segments not keeled on outer surface, densely sericeous or subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight with occasional ± slightly wavy hairs, ferruginous and tan-coloured, epidermis red, pink, orange, yellow or cream; perianth below the limb squarish in plane-view or roundish in cross-section; *dorsal tepal beard* commencing 2–2.7 mm above toral rim, beard extending for 4.5–7 mm, hairs 0.8–1.5 mm long; *ventral tepal beard* commencing 4–6.6 mm above toral rim, beard extending for 1.8–3.5 mm, hairs 0.8–1.2 mm long; *dorsal tepals* 18–20 mm long, 1.3–2.3 mm wide; *nectary* ± half-annular, projecting 0.2–0.5 mm above toral rim, margins entire or irregularly toothed, pale-yellow; *pistil* 19.2–21.5 mm long; *stipe* 2–3 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture prior to release of style-end, bowed, afterwards nearly straight to slightly incurved, with scattered minute spreading simple hairs in the upper 1/2–1/4 of style-end, particularly at back of style-end, red, pink, yellow, orange or cream; *pollen-presenter* lateral, 2.8–3.5 mm long, 2.2–3 mm wide; *face of pollen-presenter* flat in side-view (or seldom lower margins slightly incurved, giving appearance of pollen-presenter being shallowly concave as in plants from Mt Elizabeth), base concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, 18–23 mm long, 5–6 mm deep, wall 0.3–0.5 mm thick, glabrous, faintly collieulose-rugulose, with 3–5 longitudinal ridges on each side, firmly crustaceous, style persistent. (Fig. 1 a.)

Representative specimens examined: **VICTORIA**. East Gippsland: Murrindal Falls, 1937, *F. Robbins s.n.* (ACB 7760) (MEL 2146655); Murrindal Falls, 1937, *F. Robbins s.n.* (ACB 7935) (MEL 2146653); W Tree, near Buchan, x. 1947, *L. Hodge* s.n. (MEL 75168); Murrindal, W Tree Creek Buchan, 19. x. 1947, *N.A. Wakefield* 4127 (MEL 1510405); W- Tree Creek Falls, 14 mls N of Buchan, 15. i. 1948, *J.H. Willis. s.n.* (MEL 75159); Mount Elizabeth No. 2, 28. ii. 1971, *A.C. Beauglehole* 37115 (MEL 2146656); Rodger River, 2.4 km, 90 degrees E Rodger River/Snowy River junction, 16. ix. 1979, *S.J. Forbes* 177 (MEL 2146652); Museum Spur Track, 1.6 km WSW of Helipad, 12 km ENE of Mount, Murrindal, 8. ii. 1980, *N.G. Walsh* 360 (MEL 596073); Mount Elizabeth, 48 km due NE from Bairnsdale, 26. i. 1987, *N.G. Walsh* 1700 (CBG, MEL 1556351, NSW); Orbost Region, Brodribb Forest Management Block, 17. ii. 1986, *E.A. Chesterfield* 857 (MEL 1555987); 7.0 km NE along Collins Track on road to Mount Elizabeth summit, 14. x. 1986, *D.E. Albrecht* 2874 (AD, BRI, CBG, HO, MEL 2146654, NSW); Tabby forest block, c. 600 m on 35° T from confluence of Musk Creek and Rodger River, bluff 50 m above W bank of river, 11. ii. 1990, *J. Westaway* 752 (MEL 1589547); Buchan area, Tulloch Ard Road, c. 20 km NE of Buchan, 28. xii. 1990, *C. Le Breton s.n.* (MEL 698377); Mount Elizabeth, 1 km below summit on Collins Road, 23. vi. 1996, *V. Stajsic* 2159 & *P. Wlodarczyk* (AD, CANB, HO, MEL 2115715, NSW); Mount Elizabeth, c. 2 km before the summit, 23. vi. 1996, *V. Stajsic* 2160 & *P. Wlodarczyk* (AD, CANB, HO, MEL 2115717, NSW); Tulloch Ard, NW facing rocky slope above road to south near New Guinea, 8. v. 1997, *W.M. Molyneux s.n.* & *S.G. Forrester* (MEL 2115769 & 2115770); Yalmy River at Varneys Track Ford, 10 m upstream on N bank, 26. ix. 1999, *P. Geary* s.n. (MEL 2089239, MEL (Vic. Ref. Set)). Eastern Highlands: Jones Rd, c. 4 km E of Wentworth River, 30. xi. 1977, *N.G. Walsh s.n.* (MEL 524953); 'Seldom Seen' at S end of Jones's Rd. S of Wentworth River, 14. xii. 1978, *N.G. Walsh 142* (MEL 1513834); ca. 2.7 km NW from Mt Hoad (as the crow flies) on Yahoo Road, about 500 m E from junction with Bullumwaal-Mt Baldhead Road, 10. viii. 2003, *J. Stephens s.n.* (MEL 2218201).

Phenology: Flowering has been recorded from July to March. In cultivation it can flower sporadically throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: Grevillea polychroma is endemic to Victoria, the eastern limit of its range being in the Brodribb Forest Block (in Errinundra National

Park), and the western extent of its range being Seldom Seen near Dargo (not to be confused with Mt Seldom Seen which is near Wulgulmerang). Its distribution is mainly centred between Buchan and Gelantipy in East Gippsland. The type-site at Betts Creek Track, as well as the site near the confluence of the Snowy River with Rodger River are within the boundary of Snowy River National Park. The species is locally common at Mt Elizabeth but rather localised. On Yahoo Road near Mt Hoad there are about 50 plants. The Seldom Seen, Mt Hoad, W Tree, and Mt Elizabeth sites are not protected within conservation reserves. Most populations cited above are small and localised. A conservation status of Vulnerable (3VC- sensu Briggs & Leigh 1996) or Vulnerable (VU sensu IUCN 2001) is suggested.

Habitat and Ecology: Grevillea polychroma has a much broader altitudinal range and ecological amplitude than G. *brevifolia*. It is found down to as low as 80 m above sea-level at the confluence of the Snowy and the Rodger Rivers in East Gippsland, where it grows as a riparian shrub among granite tors, with *Tristaniopsis laurina* and *Acacia floribunda*, as it also does at Yalmy River at Varneys Track Ford. At Tulloch Ard at the type-site it is associated with *Xanthorrhoea australis* and *Leucopogon lanceolatus* at about 400 m above sea level. In the Tabby Forest block it is found in *Eucalyptus macrorhyncha* dominated forest.

At Mt Elizabeth it grows in different forest types on rhyolite at an elevation between 800-940 m above sea level, on dry rocky slopes beside the track. It is found in rather dry forest dominated by *Eucalyptus sieberi*. At the summit it is also associated with *Eucalyptus regnans*.

In the Brodribb Forest Block it is found in *Eucalyptus obliqua* forest at an altitude between 1000-1100 m above sea level, the highest recorded for *G. polychroma*, occurring with *Westringia glabra* amongst granitic tors in a dense scrub association of *Acacia obliquinervia* and *Oxylobium arborescens* (Chesterfield et al. 1988).

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: G. polychroma corresponds only in part with race 'f' of McGillivray & Makinson (1993). In their delineation of race 'f' they included populations which are now regarded as part of *G. parvula*, as well as including the W Tree Creek and Mt Elizabeth populations which correspond with *G. polychroma*. Olde and Marriott (1995) however, appear to be the first workers to treat the populations from the W Tree Creek and Mt Elizabeth as representing a separate taxon from *G. victoriae* var. *leptoneura*. However, the Mt Kaye population which they excluded from their concept of *G. victoriae* var. *leptoneura* should not have been excluded, as it is part of *G. parvula*. While these three populations do not constitute one taxon, what is significant is that the exclusion by Olde and Marriott of the W Tree Creek and the Mt Elizabeth populations in particular, from their concept of *G. victoriae* subsp. *leptoneura* represented an important step towards an elucidation of the *G. victoriae* var. *leptoneura* amalgam and the formation of a concept of *G. polychroma*. However, the colour illustration of '*G. victoriae*, form from W Tree Falls' in Olde & Marriott (*Grevillea Book* 3: 225 (1995)) is unlikely to be *G. polychroma*. The plant depicted has flower buds with an acute perianth-limb, a character of *G. oxyantha*, which does not occur naturally at W Tree Falls. *Grevillea* enthusiast Leo Hodge (1904-?) bred grevilleas on his property 'Poorinda' at W Tree; the photo may be of a cultivated plant.

Separating *G. polychroma* from *G. parvula* based on herbarium specimens only may on occasions be difficult. Makinson (2000) comments that some specimens of *G.*

polychroma approach some populations (Mt Kaye) of *G. parvula* very closely in most features, and that there may be some intergradation. The specimens from the Mt Kaye area are variable in the size and shape of the leaves, some being obovate and within the dimensions of *G. polychroma*. However, leaf size and shape in *G. parvula* is variable. Field examination of the Mt Kaye population by one of us (Molyneux) confirmed that the Mt Kaye population is congruent with *G. parvula*. The branchlets of the Mt Kaye plants are subvillous, and the pollen-presenter distinctly concave in cross-section.

G. polychroma differs from *G. beauboka* in that the branchlets in *G. polychroma* are usually subsericeous or subtomentose, never subvillous. The leaf lower surface in *G. polychroma* is usually sericeous or occasionally subsericeous compared with the usually subsericeous or tomentose indumentum in *G. beauboka*. The lateral veins *in G. polychroma* are either obscure or evident, compared with the usually evident to conspicuous lateral veins in *G. beauboka*. In *G. polychroma* the primary peduncles are 0.8–1 mm wide, compared with 1.0–1.4 mm wide in *G. beauboka*. In *G. polychroma* the perianth-limb is always obtuse and not keeled, the face of the pollen-presenter is flat (seldom lower margins incurved giving appearance of being slightly concave in cross-section as in some plants of the Mt Elizabeth population) and the perianth outer surface below the limb is creamish, pale- yellow, pink, pinkish-red or red. In *G. beauboka* the perianth-limb is either obtuse or subacute and slightly to moderately midline-keeled, the pollen-presenter is usually distinctly concave in cross-section, never flat, and the perianth outer surface below the limb in *G. polychroma* varies from red, pink, orange, yellow or cream, sometimes several colour forms present in the same population.

G. polychroma differs from *G. parvula* in having branchlets that are subsericeous or subtomentose, never subvillous as in *G. parvula* (seldom subtomentose as in occasional specimens from Mt Wog Wog). The new growth in *G. polychroma* is ferruginous, not pink or purplish-pink (seldom green) as in *G. parvula*. The leaf upper surface in *G. polychroma* is glossy, not dull as in *G. parvula*. The very early flower buds in *G. polychroma* are wholly ferruginous or tan, not wholly reddish-purple as in *G. parvula*. The overall colour of the perianth outer surface below the limb in *G. polychroma* varies from red, pink, orange, yellowish to cream, compared with the red or pinkish-red in *G. parvula*. The pollen-presenter is lateral and concurrent in both species, but in *G. polychroma* the face of the pollen-presenter is flat (or the lower margins incurved giving an appearance of being slightly concave as in some plants in the Mt Elizabeth population), not distinctly concave as in *G. parvula* (seldom flat as in occasional flowers on some plants at Towamba River).

A summary of the differences between *G. brevifolia*, *G. polychroma* and *G. victoriae* is given in Table 2.

Grevillea victoriae F.Muell., *Trans. Philos. Soc. Victoria* 1: 107 (1855).

Type: [Victoria] 'Along the waters of the Buffalo Range, on the summits of Mt Buller and Mt Tambo, on the sources of the Mitta Mitta, at Mt Hotham and Mt Latrobe.' [protologue]; lecto: MEL 75105!, the specimen at the left of the sheet. The sheet bears three specimens and two adjacent labels, the label at the left reading: 'Grevillea Victoriae ferd Mueller Frutex biorgyalis [2 fathoms = 12 feet] speciousus...Very rare on the shady banks of the Buffaloe creek 28 febr.53'; the label at the lower right of the sheet reading: 'Ad rivum Buffaloe creek in densis Corraeae and leptospermorum virgultis 8.Mart 53....' (lecto: fide D.J. McGillivray & R.O. Makinson, *Grevillea*, 447 (1993)) [This specimen conforms more closely to the protologue than the other syntypes]; isolecto: MEL 75105 [for label details see lectotype citation]–excluding the specimen at the left of the sheet and including the contents of the packet at the upper left of the sheet [although some of the contents have come from other type specimens]; Buffalo Creek Buffalo Range Victora [Victoria] Type (NSW *n.v.*– paper envelope containing 2 leaves, at least one of which fits neatly on a leaf-scar of the lectotype); residual syntypes: On the Buffalo creek. In moist gravely [*sic*] places. March 1853. *Baron Dr. Mueller* (MEL 75102!); Gravely [*sic*] bed of

the Buffalo Creek. March 1853. (MEL 75104!); Mount La Trobe. *s.d., Baron Dr. Mueller.* (MEL 75107!); Mount Aberdeen *ferd. Mueller,* 1853 (K–Neg.No.Kew 2283 [Mount Aberdeen is now known as 'The Horn' and is part of the 'Buffalo Range' cited by Mueller in the protologue]); Buffalo range. Victoria. *s.d., ferd. Mueller* (K-Neg.No.Kew 2284!, excluding the 2-branched inflorescence at the top left of the sheet); In summis clivis rupestribus montis Buller & in ejusdem vertice. 22. martii 53. *Dr. M* [*F. Mueller*] (MEL 75106!); Buffalo range. 1853. *ferd. Mueller* (MEL 75101!): Buffalo range, *s.d., ferd. Mueller* (NSW 93281); Mount Latrobe. *s.d, F. Mueller* (MEL 75103!).

Possible residual syntypes: Buffalo Range (A *n.v.*, LE *n.v*; MEL 75108!, NY *n.v.*); Victoria. *s.d., Dr. Mueller* (NSW 93283); Australian Alps. *s.d.*, Dr. ferd. Mueller (K–presented by Linnean Society, 1915); Victoria leg. *Diels* 7484 [*F. Mueller*] (B *n.v.*).

[some of these collections may belong to taxa that were recognised in Makinson (2000) and here as distinct, e.g. the Mt Tambo syntype locality almost certainly relates to *G. brevifolia,* and to the Type collection of that species].

Spreading to erect *shrub* (1–) 1.5–3 m (–5) high, 1.5–4.5 m (–6 m) across. *Branchlets* usually subterete, terete or biconvex, with up to eight longitudinal ridges, densely subsericeous (in subsp. *victoriae* & *nivalis*) or densely subtomentose (in subsp. *nivalis*), of biramous non-glandular hairs, epidermis not visible, the hairs mutually aligned, appressed with scattered irregularly aligned, appressed and some ascending hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white with scattered ferruginous hairs. *Colour of new growth* ferruginous soon becoming green. *Leaves* ascending (towards apex of branchlets), petiolate, simple, entire, usually narrowly elliptical to lanceolate (rarely oblanceolate) (in subsp. *victoriae*) or usually elliptic to narrowly-elliptical, occasionally ovate, rarely lanceolate or oblanceolate (in subsp. *nivalis*), (20–) 35–120 (–200) mm long, (7–) 10–35 (–50) mm wide, apex usually acute or obtuse with a short blunt mucro, *margins* flat to revolute, but can be variable in the same plant in subsp. *nivalis*; *leaf length to width ratio* 2.25:1–5:1 (–6.0:1); *leaf upper surface* minutely foveolate, glabrous or occasionally with scattered biramous non-glandular appressed, mutually aligned, silvery-white hairs (particularly in immature leaves) or occasionally microscopically asperulous (40x magnification), with microscopic T-shaped or triangular asperities or occasionally with irregularly aligned, ascending to erect, silvery-white hairs predominantly along the midvein and the lower part of lamina or just above petiole, occasionally mixed with appressed to ascending hairs or with erect irregularly aligned, ferruginous hairs, dull or glossy, mid-green to dark-green, *lateral veins* usually conspicuous to prominent but occasionally variable in the same plant, varying from evident to conspicuous (in subsp. *nivalis*); *reticulum* obscure to conspicuous, but occasionally obscure to conspicuous in the same plant and rarely absent (in subsp. *nivalis*); *leaf lower surface* densely sericeous (in subsp. *victoriae*), densely subsericeous (in subsp. *victoriae* & *nivalis*), or subtomentose (in subsp. *nivalis*), of biramous non-glandular hairs epidermis not visible, the hairs predominantly mutually aligned, appressed with scattered mutually and irregularly aligned, appressed and ascending, straight with occasional ± slightly wavy, silvery-white hairs, with occasional tan-coloured and ferruginous hairs, *lateral veins* evident to prominent, *reticulum* absent (in subsp. *victoriae*) to prominent (in subsp. *nivalis*). *Conflorescences* terminal, subterminal or axillary, decurved to pendulous, pedunculate, simple to four branched; unit conflorescence shortly conico-cylindrical or a loose ovoid cluster, acropetal; *number of flowers* (16–) 22–48 (–68) per unit conflorescence; *primary peduncles* (0–) 3–17 mm long, (1.0–) 1.2–1.6 mm wide, indumentum (as in rachises) moderately densely subsericeous of biramous non-glandular hairs, epidermis not visible or partially visible, the hairs predominantly mutually aligned, appressed, straight with occasional ± slightly wavy hairs, off-white or silvery-white, often with scattered irregularly aligned, appressed and occasional ascending tan-coloured or ferruginous hairs (in subsp. *nivalis*), *overall colour* (as in rachises) often dead-white white, or off-white; *floral rachises* (8–) 17–90 mm long; *floral bracts* narrowly-triangular, linear-crescentic in side-view, basally

truncate, apex acute but blunt-tipped, (1.0–) 1.5–2.7 mm long, 0.6–0.8 mm wide, outer surface densely subsericeous or subtomentose (in subsp. *nivalis*), epidermis not visible, predominantly mutually aligned, appressed with scattered ascending, straight with occasional ± slightly wavy hairs, ferruginous and scattered tan-coloured hairs distributed over entire length of bract or in the upper 1/2 of bract length, inner surface glabrous except just below apex, tan-coloured; *pedicels* 3–7 mm long; *torus* oblique, at 15–40° to pedicel, squarish with rounded angles; *very early flower buds* wholly ferruginous or pale-ferruginous (in subsp. *nivalis*), or perianth below the limb ferruginous and limb tan-coloured (in subsp. *victoriae*), perianth below the limb maturing to red or pinkish-red, limb maturing to ferruginous; *advanced buds (pre-anthesis)* acroscopic, maturing to ± acroscopic to variably retrorse; *perianth below the limb* squarish in cross-section with rounded angles; *perianth outer surface below the limb* moderately densely subsericeous (in subsp. *victoriae*), subtomentose (in subsp. *victoriae* and *nivalis*), or tomentose (in subsp. *victoriae* and *nivalis*) of biramous non-glandular hairs, epidermis partially visible or not visible, the hairs predominantly mutually aligned, appressed and ascending, with scattered irregularly aligned appressed and ascending hairs, straight and slightly wavy, ferruginous with occasional tan-coloured hairs, epidermis red or pinkish-red, overall perianth colour red or reddish-pink; *perianth inner surface epidermis below the limb* usually minutely papillate below beard, papillae particularly conspicuous along tepal margins where they are often larger and form minute simple hairs, glabrous except for beard, red or reddish-pink; *perianth-limb* subglobose in side-view, squarish with rounded angles face-on, apex obtuse, limb-segments not keeled or seldom slightly to moderately midline-keeled on outer surface, densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed with scattered mutually and irregularly aligned appressed and ascending hairs, straight and slightly wavy, ferruginous, epidermis red or reddish-pink, overall perianth colour red or pinkish-red; *dorsal tepal beard* commencing 1.5–3 mm above toral rim, beard extending for 4.2–5.7 mm, hairs 1.2–1.5 mm long; *ventral tepal beard* commencing (4.3–) 5–6 mm above toral rim, beard extending for 1.3–3 mm, hairs 1.2–1.5 mm long; *dorsal tepals* 18.2–22 (–23.5) mm long, 1.9–2.5 mm; *nectary* half-annular, projecting 0.4–0.6 mm above toral rim, margin entire or tridentate, pale-yellow; *stipe* 1.5–3 mm long, glabrous; *ovary* glabrous, green; *style* exserted from dorsal suture of perianth prior to release of style-end, bowed, afterwards nearly straight to slightly incurved, indumentum sparse, with scattered minute spreading simple hairs in upper 3/4 to 1/4 of style length, particularly at back of style-end, red or reddish-pink; *pistil* (18–) 19.7–22.5 (–25) mm long; *pollen-presenter* oblique to style, 2.5–3.1 mm long, (1.7–) 2.2–2.7 mm wide; *face of pollen-presenter* ± flat or slightly convex, base not concurrent with the style; *stigma* distally off-centre; *follicle* ovoid/ellipsoid, (16–) 20–25 mm long, 5–7 mm deep, wall 0.5–0.7 mm thick, glabrous, faintly colliculose-rugulose, with several longitudinal ridges on each side, firmly crustaceous, style persistent.

Notes: Willis (1973) recognised two varieties within *G. victoriae*, *G. victoriae* var. *victoriae* and *G. victoriae* var. *leptoneura*. Under *G. victoriae* he cited specimens from Lake Mountain and Mt. Torbreck, Mts. Buller & Stirling, Barry Mts., Mt Buffalo, Bogong High Plains, Mt. Hotham, Mt. Tambo, Cobboras [Cobberas], Wombargo Range, Nunniong Plateau, near W Tree, and Mt Tingaringy. Several different taxa are encompassed here: *G. brevifolia* (Mt. Tambo, Cobboras [Cobberas], Wombargo Range, Nunniong Plateau, Mt Tingaringy), *G. monslacana* (Lake Mountain), *G. polychroma* (near W Tree), and *G. victoriae* subsp. *victoriae* (Mt. Torbreck, Mts. Buller & Stirling, Barry Mts., Mt Buffalo, Bogong High Plains, Mt. Hotham). New South Wales is mentioned only in vague terms 'southern parts of the Dividing Range'.

Makinson (1991) in his account of the *Grevillea* in *Flora of New South Wales* recognised a broad concept of *G. victoriae*, which included *G. miqueliana*. McGillivray and Makinson (1993) also recognised a broad concept of *G. victoriae*, which included *G. miqueliana*, but additionally delineated eleven informal 'races' and identified an

additional eight specimens as being unassignable. See Table 4 for a summary of McGillivray & Makinson's (1993) 'races' and 'unassigned specimens' and their current names/taxonomic placement.

Olde & Marriott (1995) recognised three varieties: *G. victoriae* var. *victoriae* (which encompasses *G. victoriae* F.Muell. subsp. *victoriae* and *G. victoriae* subsp. *nivalis* Stajsic & Molyneux), *G. victoriae* F.Muell. var. *brevifolia* (F.Muell. ex Benth.) F.Muell. ex Maiden & Betche (*G. brevifolia* F.Muell. ex Benth.) and *G. victoriae* var. *leptoneura* Benth. (*G. parvula*, 2000). They also recognised the 'Lake Mountain form' (*G. monslacana* Molyneux & Stajsic in Makinson (2000)), *G.* sp. aff. *victoriae* 'A' (*G. oxyantha* Makinson subsp. *oxyantha* and *G. oxyantha* subsp. *ecarinata* Makinson 1998), and *G.* sp. aff. *victoriae* 'B' (*G. rhyolitica* Makinson subsp. *rhyolitica* and *G. rhyolitica* subsp. *semivestita* Makinson).

Grevillea victoriae occurs in the subalpine and alpine regions of the Southern Tablelands of New South Wales, and high montane, subalpine and alpine regions of Victoria. Two subspecies are recognised. References in McGillivray & Makinson (1993) to occurrences of *G. victoriae* in Queensland refer to the taxon now recognised as *G. hockingsii*.

The floral rachis indumentum of *G. victoriae* is often dead-white, contrasting strongly with the ferruginous flower buds. Other taxa sharing this feature are *G. diminuta*, which has much smaller leaves ≤ 2 cm longer and a shorter pistil 10–11 m long, and *G. oxyantha*, which has a pyramidal perianth-limb of the flower bud (subglobose and obtuse in *G. victoriae*). Other related taxa have the overall rachis indumentum colour reddish, pale tan-coloured, or off-white, rarely pale but with the buds usually red, not ferruginous.

The colour of vegetative growth in *G. victoriae* is ferruginous or green, never pink or purplish-pink as in *G. callichlaena*, *G. epicroca*, some populations of *G. oxyantha and G. parvula*.

The summary of the differences between *G. victoriae, G. brevifolia*, *G. miqueliana*, and *G. polychroma* are given in Table 2; see also the Notes section for *G. brevifolia* and *G. miqueliana*.

Grevillea victoriae F.Muell. subsp. ***victoriae***

G. victoriae F.Muell. 'race c', of D.J. McGillivray & R.O. Makinson, *Grevillea*: 321 (1993).

G. victoriae F.Muell. var. *victoriae*, of P.M. Olde & N.R. Marriott, *Grevillea Book* 3: 224 (1995), *p.p.*

G. victoriae F.Muell. 'race c', of R.O. Makinson, *Flora of Victoria* 3: 852 (1996).

Illustrations: G.R. Cochrane, B.A. Fuhrer, E.R. Rotherham & J.H. Willis, *Flowers and Plants of Victoria*: 161 (1968), as *G. victoriae*; P.M. Olde & N.R. Marriott, *Grevillea Book* 3: 224 (1995); L. Costermans, *Native Trees and Shrubs of South-Eastern Australia*: 160 (1985 reprint), as *G. victoriae*; M.G. Corrick & B. Fuhrer, *Wildflowers of Victoria*: 188 (2000), as *G. victoriae*.

Branchlets densely subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs mutually aligned, predominantly appressed with scattered irregularly aligned appressed and some ascending hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white. *Leaves* usually narrowly elliptical to lanceolate (rarely oblanceolate), (30-) 40–120 (–200) mm long, (8–) 10–25 mm (–50) mm wide, apex usually acute with a short blunt mucro or occasionally obtuse, margins shortly recurved; *leaf length to width ratio* (2.85:1–) 4:1–5:1 (–6:1); *leaf upper surface* glabrous and minutely foveolate, or with scattered mutually aligned, appressed, silvery-white biramous non-glandular hairs, dull, dark-green, *lateral veins* conspicuous, *reticulum* obscure; *leaf lower surface* densely sericeous or subsericeous of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, appressed, straight or

with occasional ± slightly wavy hairs, silvery-white with or without occasional irregularly aligned, appressed or ascending silvery-white, tan-coloured and/or ferruginous hairs, *lateral veins* evident or occasionally obscure, *reticulum* absent; leathery textured; *Conflorescences* simple to thrice-branched, simple 69%, once-branched 20%, twice-branched 9%, thriee-branched 2%; *floral rachises* (17–) 40–90 mm long. (Fig. 1 f.)

Representative specimens examined: **VICTORIA**. Snowfields: Sources of the Dargo, i. 1891, *C. Walter s.n.* (MEL 2148384); Buffalo Mountains, x. 1891, *C. Walter s.n.* (MEL 560245); Mt. St Bernard, i. 1900, *J.H. Maiden s.n.* (NSW 93284): Mt Hotham, 18. i. 1913, *R.H. Cambage* 3713 (NSW 93287); Buffalo Mountains, i. 1923, *M. Nettie s.n.* (NSW 93282); Mt Bogong, i. 1924, ? *A.J. Tadgell s.n.* (MEL 2145439); Mt Hotham, 30. i. 1938, *J.H. Willis s.n.* (MEL 75152); Track from Horn Hut to Horn, 22. xii. 1952, *B.G. Briggs s.n.* (NSW 93280); Macalister Springs, 1 mile east of summit of Mt Howitt 25. xii. 1960, *T.B. Muir* 2023 (MEL 1510179); Bogong High Plains, near Wilkinson Lodge, 5. xi. 1961, *T.B. Muir* 2498 (MEL 2148385); About 1 mile below Falls Creek on road to Mt Beauty, 29. xii. 1966, *A. Rodd* 384 (NSW 96936): Bogong High Plains, North Nelse Creek, south side of Spion Kopje, 23. i. 1967, *A.C. Beauglehole* 22337 (MEL 2148410); Mt Buller, 8. i. 1969, *M. Allender s.n.* (MEL 75132); The Razorback, between Mts Feathertop and Hotham, 1. ii. 1969, *L.A. Craven* 1525 (CANB, MEL 75147); Mt McKay-Howmans Gap Road, 3 km W of Falls Creek, 6. i. 1972, *L.G. Adams* 2647 (CANB, K, L, MEL 571769, NSW); Macalister Springs area near Mt Howitt, 28 xii. 1972, *A.C Beauglehole* 40788 (MEL 559195, NSW); Mt St. Bernard near summit, 27. iii. 1973, *A.C. Beauglegole* 41190 (MEL 559196, NSW); Mt Buffalo, Reservoir Road, 13. xi. 1973, *M.A. Todd* 162 (MEL 558749); Mt Hotham development grid, 24. xi. 1979, *S.J. Forbes* 436 (MEL 594902); Mt Buffalo National Park, ca. 200 m down from summit of Mt. MeLeod, 27. i. 1982, *P.S. Short* 1382 (MEL 601854); Red Robin Mine, 23. ii. 1983, *C. Beardsell s.n.* (MEL 1563267); Mt Torbreck summit walking track (near summit), 6. i. 1984, *D.E. Albrecht* 112 (MEL 663503); Mt Buffalo National Park, Mt Buffalo, 0.5 km N of Stanley Rocks wlk traek and road junetion, 18. xii. 1987, *J.L. Porter* 009 & *B.J. Conn* (AD, MEL 1578973, NSW 197042); Mt Buffalo National Park, 2.6 km by road N of Cresta Valley, 12. xi. 1988, *B.J. Conn* 3052 (CHR, MEL 119291, MO, NSW 218455); Rubicon State Forest, Mount Torbreck, ca. 800 m ESE from carpark/campsite 2. vi. 1996, *V. Stajsic* 2139, 2140 & *W.M. Molyneux* (AD, CANB, HO, MEL 2114515, 2114517, NSW); Mount Buffalo National Park, at the Leviathan on Mount Buffalo Road, 21. vi. 1996, *V. Stajsic* 2149 & *P. Wlodarczyk* (AD, CANB, HO, MEL 2114546, NSW); Mount Buffalo National Park, on slope above Bunyip Creek, on Mt Buffalo Road, 21. vi. 1996, *V. Stajsic* 2152 & *P. Wlodarczyk* (CANB, MEL 2114552, NSW); Bogong Highplains Road at Falls Creek Village on slope overlooking town, 22. vi. 1996, *V. Stajsic* 2157 & *P. Wlodarczyk* (AD, CANB, MEL 2115711); C. 39 km from Licola towards Jamieson, high slopes above road, 6. xi. 2002, *P.M. Olde* 02/303 & *Grevillea Study Group* (BRI, CANB, MEL 2233943, NSW).

Phenology: Flowering has been recorded primarily between October and February, but in the absence of snow can sporadically occur throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it assumed that the plants are primarily ornithophilous.

Distribution and Conservation Status: Grevillea victoriae subsp. *victoriae* is endemic to Victoria, primarily on the Mt Buller, Mt Buffalo and the Mt Bogong massifs, but also at Mt Torbreek, Mt St Bernard, Mt Hotham and Mt Howitt. *Grevillea v.* subsp. *victoriae* is adequately represented in the Alpine National Park, being common at a number of localities such as in the Buffalo National Park and in the Alpine National Park near Falls Creek village. However, some populations such as the disjunct population at Mt Torbreek aren't protected in a conservation reserve. *Grevillea v.* subsp. *victoriae* is not considered to be under any current threat.

Habitat and Ecology: Grevillea victoriae subsp. *victoriae* grows in subalpine and alpine regions, between 1400 and 1900 m above sea level, usually on granites in *Eucalyptus pauciflora* woodland, with frequent associated species including *Acacia alpina, Bossiaea foliosa, Ozothamnus secundiflorus, Pimelea alpina* and *Podolobium alpestre*. On the road between Bogong and Falls Creek Village it also grows on slopes above the road in a *Eucalyptus dalrympleana* and *E. pauciflora* association. At Mt

Buffalo it also grows on boulder strewn creek banks with *Acacia alpina, Babingtonia crenulata, Derwentia derwentiana, Empodisma minus,* and *Westringia senifolia.*

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Grevillea victoriae subsp. *victoriae* is a relatively uniform species exhibiting only minor variation in leaf size and shape across its range, and even the most disjunct population at Mt Torbreck (the most southwesterly) exhibits no apparent morphological differences with other populations of *G. victoriae* subsp. *victoriae.*

For differences between *G. victoriae* subsp. *victoriae* and *G. victoriae* subsp. *nivalis* refer to notes under the latter subspecies, the key and Table 2.

Grevillea victoriae F.Muell. **subsp. *nivalis*** Stajsic & Molyneux, in Makinson (2000), *Flora of Australia* 17A: 502.

Type: New South Wales, near Tooma Reservoir, 29. ix. 1973, *R.J. Chinnock* 298 (holo: CANB 492764; iso: AD *n.v.*).

G. victoriae F.Muell. of R.O. Makinson, *Flora of New South Wales* 2: 49 (1991).

G. victoriae F.Muell. 'race d'of D.J. McGillivray & R.O. Makinson, *Grevillea*: 321 (1993).

G. victoriae F.Muell. var. *victoriae* of P.M. Olde & N.R. Marriott, *Grevillea Book* 3: 224 (1995), *p.p.*

Illustrations: A.B. Costin, M. Gray, C.J. Totterdell & D.J. Wimbush, *Kosciusko Alpine Flora* (plates 151 & 152) (1982), as *G. victoriae*; P.M. Olde & N.R. Marriott, *Grevillea* Book 3: 224 (plate 184A) (1995), a cultivated form, as *G. victoriae* 'Murray Queen'.

Spreading to erect *shrub* (1.0–) 1.5–2.5 m high, 2–4.5 (–6) m across. *Branchlets* moderately densely subsericeous or densely subtomentose, of biramous non-glandular hairs, epidermis not visible, the hairs mutually aligned, predominantly appressed with scattered irregularly aligned, appressed and scattered ascending hairs, predominantly straight with occasional ± slightly wavy hairs, silvery-white with scattered ferruginous hairs; *Leaves* usually elliptic to narrowly-elliptical, occasionally ovate, rarely lanceolate or oblanceolate (20–) 35–100 (–135) mm long, (7–) 15–37 mm wide, apex acute with a short blunt mucro or obtuse, *margins* flat or almost so, rarely rolled or revolute, but can be variable in the same plant; *leaf length to width ratio* 2.25–4.0:1(–5.0:1); *leaf upper surface* minutely foveolate, glabrous or occasionally microscopically asperulous (40x magnification), with microscopic T-shaped or triangular asperities, smooth to touch, and/or with scattered mutually aligned, appressed, biramous non-glandular silvery-white hairs or occasionally with irregularly aligned, ascending to suberect biramous non-glandular silvery-white hairs, predominantly along the midvein and lower part of lamina or just above the petiole, occasionally mixed with appressed to irregularly aligned, ascending to erect biramous non-glandular ferruginous hairs, usually semi-glossy particularly the younger leaves which are usually bright green, maturing to mid-green to dark-green. *lateral veins* usually conspicuous to prominent but occasionally variable in the same plant, varying from evident to prominent, *reticulum* usually evident but varying from obscure to conspicuous sometimes in the same plant, rarely absent; *leaf lower surface* densely subsericeous or subtomentose of biramous non-glandular hairs, epidermis not visible, the hairs predominantly mutually aligned, predominantly appressed with scattered mutually and irregularly aligned appressed and ascending hairs, predominantly straight

with occasional ± slightly wavy hairs, silvery-white with occasional tan-coloured and ferruginous hairs, *lateral veins* evident to conspicuous, occasionally prominent, *reticulum* conspicuous or occasionally prominent, rarely obscure or absent; leathery-textured. *Conflorescences* simple to thrice-branched, simple 43.16%, once-branched 47%, twice-branched 7.84%, thrice-branched 2%; *overall colour* (as in rachises) often dead-white, or off-white; *floral rachises* (8–) 10–50 (-60) mm long. (Fig. 1 f.)

Representative specimens examined: **NEW SOUTH WALES.** Southern Tablelands: Tooma, *s.d.*, Miss [*F.*] *Campbell* 4 (MEL 75119); Dredbo [Thredbo] River. xi. 1887, *W. Bauerlen s.n.* (MEL 75115); Tumut, ix. 1890, collector unknown (NSW 93296); Mount Kosciusko, above snow line. i. 1896, *J.M. Curran s.n.* (MEL 75139; NSW 93300); Manjar Mountain, E from Toomah Station, i. 1904, *W. Adams s.n.* (NSW 93295); Mt Kosciusko, xii. 1924, *T. Harris s.n.* (NSW 93307); Mt Kosciusko, vi. 1932, *E.C. Andrews s.n.* (NSW 93301); Near top of Hammel's Spur, Snowy Mountains, 26. i. 1948, *A.R. Tinckman* (NSW 93305); Tumut Pond, 1951, *J.C. Newman s.n.* (NSW 93291); Munyang River Valley, Snowy Mountains, 29 ix. 1952, *M. Mueller* 656 (NSW 93304); Beacon Hill, near Tabletop Mountain, above the plateau east of Tumut River and shortly below the junction of Happy Jacks River and Lake Tumut, 9. i. 1953, *M. Mueller* 658 (NSW 93288); Near junction of Tumut River and Happy Jacks River, Snowy Mountains, 30. iv. 1954, *C.W.E. Moore* 2935 (NSW 93289); Dead Horse Gap on Alpine Way, S of Ramshead Range. Kosciusko Plateau, 11. iv. 1958, *J. Vickery s.n.* (NSW 93302); Near Dickie Cooper's Bogong, on Valentine River Track, Snowy Mountains, 4. xi. 1961, *M.E. Phillips s.n.* (NSW 450180); Happy Jacks Range, south of Kiandra, xi. 1964, *K.M. Cooper s.n.* (NSW 96976); Grey Mare Range, 1/2 mile NE of the Grey Mare, 28. xii. 1968, *A. Rodd* 706 (NSW 131987); 1 mile SW of Kiandra, on road to Cabramurra, 22. iii. 1969, *L.A.S. Johnson & B.G. Briggs* (NSW 130082); Junction of Yorkers Creek and Tumut River, x. 1971, *A.E. Logan* 3 (NSW 450206); Kosciusko National Park, The Sentinel, 16. i. 1972, *J. Simons (J. Thompson* 1324) (NSW 450207); Kosciusko National Park, Snowy River at Island Bend, 16 km NW of Jindabyne, 20. iii. 1974, *R. Coveny* 5386 (NSW 450210); Slopes of Round Mountain near Cabramurra, 27. iv. 1980, *V. Murtagh s.n.* (NSW 450222); Holland's Crossing on Snowy River, 5 km SE Jindabyne township, 22. x. 1981, *S.F. Forbes* 536 (MEL 603600); Kosciusko National Park, Geehi River, at bridge where the Schlink Pass-Geehi Reservoir Road crosses river, 3. iii. 1984, *B.J. & H.M. Conn* 1441 (MEL 658204, NSW); Kosciuszko National Park, 13.6 km from Tom Groggin Camp Ground on road to Thredbo, 27. xii. 1996, *V. Stajsic* 2508 & *G.W. Carr* (AD, CANB, HO, MEL 2117643, NSW); Kosciuszko National Park, 15.5 km from Tom Groggin Camp Ground on road to Thredbo, 27. xii. 1996, *V. Stajsic* 2509, 2521 & *G.W. Carr* (AD, CANB, HO, MEL 2117645, 2117651, NSW); Kosciuszko National Park, on road to Cabramurra, 8.7 km from Link Track, 0.75 km from Tooma Dam, 27. xii. 1996, *V. Stajsic* 2523 & *G.W. Carr* (CANB, MEL 2117655); Kosciuszko National Park, on road to Cabramurra, above Tooma Dam, 1.1 km at bridge of Tooma Dam, 28. xii 1996, *V. Stajsic* 2525 & *G.W. Carr* (AD, CANB, MEL 2117658, NSW); Kosciuszko National Park, Tumut Ponds Fire Trail, 2.5 km SSW from 'Kings Cross', 4 km SE from Cabramurra, 9. xii. 1998, *N.G. Walsh* 4890, *K. McDougall, & G. Wright* (MEL 2054143). **VICTORIA.** On forest rivulets on the Upper Hume River, i. 1874, *F. Mueller s.n.* (MEL 75109, 75110, 75111, 75112); Snowfields: Alpine National Park, ca. 1.8-2.0 km SW from the summit of Mt Pinnibar, on Shady Creek Track, 26. i. 2002, *P. Ashton s.n.* (MEL 2125387); Mount Sassafras, 7. i. 2003, *P. Ashton s.n.* (Seedling: MEL 2185832, 2185833, 2185834, 2185835, 2185836, 2185837, 2185838); Mount Gibbo, 30. i. 2003. *P. Ashton s.n.* (MEL 2185830, 2185831).

Phenology: Flowering has been recorded primarily between October and February, but in the absence of snow can sporadically occur throughout the year. Nectarivorous birds and in particular honeyeaters of various species visit the flowers, and it assumed that the plants are primarily ornithophilous.

Distribution and Conservation status: Grevillea victoriae subsp. *nivalis* primarily occurs in the Kosciuszko National Park in New South Wales on the western flank of the Kosciuszko massif, from The Pilot north to Talbingo and towards Tumut, extending south to Mtns Gibbo, Pinnibar and Sassafras in Victoria. The Pilot site is particularly interesting in that it is a site where *G. victoriae* subsp. *nivalis* is sympatric with *G. brevifolia* (Molyneux pers. observ. ca. 20 years ago). F. Mueller made a number of collections from the 'Upper Hume River' in January 1874 and presumably some of these collections

possibly have come from the Victorian side of the river. In Victoria the species is only known from several recent specimens collected by Peter Ashton between January 2002 and January 2003 from near Mt Pinnibar, Mt Gibbo and Mt Sassafras. The populations at the Mt Gibbo and Mt Sassafras sites were discovered during firefighting efforts during the devastating fires of January 2003, which burnt vast areas of eastern Victoria. Both sites were burnt out in these fires, fortunately however, regeneration has occurred from soil-stored seed with many seedlings observed by one of us (Molyneux) during a recent visit to Mt Sassafras. Previously the most recent report of this taxon in Victoria was sighted by one of us (Molyneux) in the 1970's on the Victorian side of the Murray River, at the Tom Groggin crossing, however no herbarium voucher specimen was collected at the time. In New South Wales *G. victoriae* subsp. *nivalis* appears to be adequately reserved within Kosciuszko National Park where it is reasonably common at a number of localities, and does not appear to be under any threat. In Victoria however, it is known from only three recently discovered populations: near Mt Pinnibar, near Mt Sassafras and Mt Gibbo. The Mt Pinnibar population is reserved within the Alpine National Park, the other two populations are not within a reserve system. A conservation status of Endangered (2EC- *sensu* Briggs & Leigh 1996) or Endangered (EN *sensu* IUCN 2001) is suggested for the Victorian populations.

Habitat and Ecology: Grevillea victoriae subsp. *nivalis* has a much broader elevational range than subsp. *victoriae*, occurring between 500 and 1900 m above sea level. It was once recorded as growing at Tom Groggin on the Murray River (south of Corryong in Victoria), which is approximately 500 m above sea level. At New Hollands Crossing on the Snowy River in New South Wales it grows at an altitude of approximately 850 m above sea level. This would seem to support the view that *G. v.* subsp. *nivalis* may have been more widely distributed at lower elevations in the Upper Murray region of Victoria, as suggested by a number of F. Mueller collections from the "Upper Hume River." At Tom Groggin it formerly occurred in the riparian zone (Molyneux pers. observ in the 1970's). At New Hollands Crossing it also grows in the riparian zone, associated with *Eucalyptus viminalis, Kunzea phylicoides* and **Rubus* sp (*fruticosus* complex). At the Tooma Dam it grows in *Eucalyptus stellulata* dominated low forest with the occasional *Eucalyptus pauciflora* subsp. *niphophila*.

On the road between Tom Groggin and the Dead Horse Gap it grows in tall *Eucalyptus delegatensis* forest with an occasional *Eucalyptus pauciflora* subsp. *niphophila*. On the road to Cabramurra between Khancoban and the Tooma Reservoir it was found growing beside the road in tall *Eucalyptus delegatensis* and *E. dalrympleana* forest with the understorey dominated by *Bossiaea foliosa* and *Tasmannia xerophila*.

More typically it is found in subalpine and alpine woodlands in *Eucalyptus pauciflora* woodland, often on granites and slates. Near Mt Pinnibar in Victoria it occurs on the boundary of Boebuck Adamillite and sedimentary pinnacle sandstone in *Eucalyptus pauciflora* woodland. No other member of the *G. victoriae* species complex occurs at higher elevations as does *G. victoriae* subsp. *nivalis*, and appears to be even marginal above the tree line, being found for example on Sentinel Peak (1917 m altitude at the summit) (Costin et al 1982).

There are no records of vegetative reproduction. Plants are killed outright by severe fire and regeneration is from seed only, as illustrated by the fires of January 2003. Long-term fire regimes may be significant for local populations. Some forms of forest management such as regular cool-burns could threaten the existence or long term survival of some populations if the period between the burns is not sufficiently long enough to allow seed regenerated plants to reach a flowering and seeding stage. Given that some populations occur along vehicle-tracks, care must be taken not to eliminate these populations through road works.

Notes: Grevillea victoriae subsp. *nivalis* corresponds with the informal race 'd' in McGillivray & Makinson (1993). Olde and Marriott (1995) treat this taxon under *G.*

victoriae var. *victoriae* together with race 'c' (which is the type taxon of *G. victoriae).* *Grevillea v.* subsp. *uivalis* is a well known taxon and has largely been popularised through the nursery trade where it has been sold as *G. victoriae* 'Murray Queen' which is thought to have been introdueed into horticulture from a collection near Dead Horse Gap south from Thredbo, in the Koseiusko National Park, in New South Wales.

Grevillea victoriae subsp. *uivalis* is very closely related to *G. victoriae* subsp. *victoriae. Grevillea v.* subsp. *uivalis* differs in having elliptic to narrowly-elliptical or rarely ovate leaves, with a length to width ratio 2.25:1–4:1 (–5:1), leaf margins that are flat or very shortly recurved. and a leaf upper surfaee that is either glabrous/smooth or microseopieally asperulous (40x magnifiеation) (smooth to touch), and semi-glossy. In eomparison, *Grevillea v.* subsp. *victoriae* usually has narrowly elliptieal to laneeolate (rarely oblanceolate) leaves, with a length to width (3:1–) 4:1–5:1 (–6:1), leaf margins that are shortly reeurved, a leaf upper surfaee that is never microseopieally asperulous, and usually dull. The leaf lower surfaee in *G. v.* subsp. *victoriae* is usually densely sericeous or oeeasionally subserieeous, usually 'tidy' with appressed mutually aligned hairs (only with the oecasional ascending or suberect ferruginous hairs) whereas in *G. v.* subsp. *uivalis* the leaf lower surface is densely subsericeous, or subtomentose and slightly 'messy'. In *G. v.* subsp. *uivalis* the leaf lower surface reticulum is usually conspicuous or prominent, and the floral rachises are (8–) 10–50 (–60) mm long. Confloreseences are simple to thrice-branched: simple = 43.16%, once-branehed = 47%, twice-branched = 7.84%, thriee-branched = 2%. As eompared to *G. v.* subsp. *victoriae* in which the leaf lower surfaee retieulum is absent or obseure, and the floral rachises (17–) 40–90 mm long. Confloreseenees are simple to thrice-branehed: simple 69%, onee-branehed 20%, twiee-branched 9%, thrice-branehed 2%.

G. diuiuuta has much smaller leaves <20 mm long, and charaeteristieally zygomorphic perianths with much shorter pistils 10–11 mm long.

The most charaeteristic difference between *G. oxyautha* subsp. *ecarinata* and *G. victoriae* subsp. *uivalis* is the subpyramidal and acute perianth-limb of the flower bud. The perianth-limb in *G. v.* subsp. *uivalis* is subglobose and obtuse. The very early flower buds in *G. o.* subsp. *ecariuata* also tend to either spread at right angles to the stem or faee upwards towards the apex of shoots as they do in *G. o.* subsp. *oxyautha*, in contrast to the downward facing flower buds in *G. v.* subsp. *uivalis*. The leaf upper surfaee venation in *G. o.* subsp. *ecarinata* is obseure to evident and the leaves are dull.

Makinson (2000) commented that the population in the Baldy Range area in the Brindabella National Park, north of the border between the Australian Capital Territory and New South Wales is closely related to (if not part of) *G. victoriae* subsp. *uivalis*. Vegetatively this taxon shares a superficial resemblanee with *G. victoriae* subsp. *uivalis*, but the Baldy Range entity is unique in the species complex in that there are seattered hairs at some stage on the ovary either pre-anthesis, anthesis or post-anthesis, and usually on the follicles. Although inconstant, simple glandular hairs are also found on very young flower buds. It is a distinet species, which will be described by the authors in a subsequent paper. The taxon also occurs at Waterfall Creek and at Genges Trig within the Brindabella National Park (N.S.W.), it does not occur in the Australian Capital Territory.

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Table 4. A summary of McGillivray & Makinson's (1993) 'races' and 'unassigned specimens' and their current names/taxonomic placement.

Race or unassigned specimen sensu McGillivray & Makinson (1993)	**Current name/taxonomic placement, authority & year of publication**
Race 'a'	*G. oxyantha* Makinson (1997) subsp. *oxyantha*
Race 'b'	*G. oxyantha* subsp. *ecarinata* Makinson
Race 'c'	*G. victoriae* F.Muell. (1855) subsp. *victoriae*
Race 'd'	*G. victoriae* F.Muell. subsp. *nivalis* (2000) Stajsie & Molyneux
Race 'e'	*G. brevifolia* F.Muell. ex Benth. (1870)
Race 'f'	*G. parvula* Molyneux & Stajsie in Makinson (2000) (in part only) *G. brevifolia* subsp. *polychroma* (Molyneux & Stajsie in Makinson (2000)) (in part only) *G. polychroma* Molyneux & Stajsie comb. et stat. nov. (2005) (in part only)
Race 'g'	*G. rhyolitica* Makinson subsp. *semivestita* Makinson (1997)
Race 'h'	*G. mouslacana* Molyneux & Stajsie in Makinson (2000)
Race 'j'	*G. miqueliana* F.Muell. (1855) subsp. *miqueliana*
Race 'k'	*G. miqueliana* F.Muell. subsp. *moroka* Molyneux & Stajsie in Makinson (2000)
Race 'l'	*G. irrasa* Makinson (1997) subsp. *irrasa*
Unassigned specimen 1	*G. oxyantha* Makinson (1997) subsp. *oxyantha sens. lat.*
Unassigned specimen 2	*G. oxyantha* Makinson subsp. *ecarinata* Makinson
Unassigned specimen 3	*G. brevifolia* F.Muell. ex Benth. (1870)
Unassigned specimen 4	Currently unassigned
Unassigned specimen 5	*G. epicroca* Stajsie & Molyneux (2000)
Unassigned specimen 6	*G. brevifolia* F.Muell. ex Benth. (1870)
Unassigned specimen 7	*G. rhyolitica* Makinson (1997) subsp. *rhyolitica*
Unassigned specimen 8	*G. hockingsii* Molyneux & Olde (1994)

submitting the first ever specimens of *Grevillea callichlaena* to MEL and for drawing our attention to it and for her general knowledge and enthusiasm for the flora of northeastern Victoria. We are grateful to Jackie Miles from Brogo who assisted one of us (Stajsic) with fieldwork in locating the known populations of *G. beauboka* and provided specimens, all which greatly aided our understanding of this species. Also thanks to John Knight from Eurobodalla for assisting one of us (Molyneux) with fieldwork. Thanks to Don McGillivray for many decades of friendship and support to one of us (Molyneux). Thanks to Jim Ross (MEL) for his support and friendship, as well as financial assistance to one of us (Stajsic) for fieldwork to the southern New South Wales. Thanks to Neville Walsh (MEL) who kindly wrote the Latin diagnoses and Niels Klazenga (MEL) for producing the ARCVIEW maps. Many thanks to Rita Macheda (MEL) for painstakingly databasing numerous collections of one of us (Stajsic) and other *Grevillea* specimens cited in this paper, whose assistance greatly facilitated getting the paper complete, and many thanks to Sue Forrester for her support, computer assistance and catering. The Herbarium of New South Wales provided the *Grevillea* loan and partial financial support for fieldwork to the Southern New South Wales for one fieldtrip, and many thanks to Andrew Orme and Robert Coveny (both from NSW) for their very generous assistance and company during field work, and a further thanks to Robert Coveny for his friendship to one of us (Stajsic). Thanks to Joe Stephens (parks ranger from Bairnsdale in Victoria) for providing material of the new population of *G. polychroma*) he discovered, and thanks to David Parkes and Colin Smith (both from DSE) for information about the Bowen Track/Scrubby Track population of *G. brevifolia*. Our appreciation also goes to the National Herbarium of Victoria for organising the loan from NSW and in particular thanks to Cathryn Coles (previously at MEL) for her support and friendship to one of us (Stajsic). Thanks to Neil Marriott (Stawell) for informing one of us (Stajsic) of the presence of *Grevillea callichlaena* in cultivation at the property of Martin Rigg at Yackandandah. We are also grateful to the two anonymous reviewers of our paper.

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DSE = Department of Sustainability and Environment (Victoria).
Ecology Australia = Ecology Australia Pty. Ltd, Fairfield, Victoria.
Greybox & Grasslands = Greybox and Grasslands Indigenous Nursery, Balliang East, Victoria.
Hume City Council = Dallas, Victoria.
MEL = National Herbarium of Victoria
NSW = National Herbarium of New South Wales

References:

Aston, H.I. (1984). Publication of early scientific journals in Victoria. *Muelleria* **5**, 281-288.

Bentham, G. (1870). *Flora Australiensis*, Vol. 5. (Reeve: London.)

Briggs, J.D. & Leigh, J.H. (1996). *Rare and Threatened Australian Plants*, Revised Edition. CSIRO and Australian Nature Conservation Agency, Canberra.

Chesterfield, E.A., Hurley, V.A., Henry, S.R., Schulz, M., and Pyrke, A.F. (1988). Ecological Survey Report No. 19. *Flora and Fauna of the Brodribb Forest Block, East Gippsland, Victoria*. Department of Conservation, Forests and Lands.

Cochrane, G.R. 1968. *Flowers and Plants in Colour* (Australian Flora in Colour series). A.H. & A.W. Reed. Printed in Tokyo by Kyodo Printing Co. Ltd.

Corrick, M.G. & Fuhrer, B.A. (2000). *Wildflowers of Victoria*. Bloomings Books, Hawthorn, Australia. Sanwha Printing Co. Ltd.

Costermans, L. 1985 (reprint). *Native Trees and Shrubs of South-Eastern Australia*. Rigby Publishers. Printed in Hong Kong by Toppan printing Company (H.K.) Limited.

Costin, A.B., Gray, M., Totterdell, C.J., and Wimbush, D.J. (1982). *Kosciusko Alpine Flora*. (CSIRO and William Collins Pty Ltd: Adelaide.)

Hart, J.M., and Henwood, M.J. (1996). The taxonomic web of the Grey Spider-Flower: *Grevillea buxifolia* (Proteaceae). *Telopea* **7**, 65-76.

IUCN (2001). *IUCN Red List of Categories and Criteria (version 3.1)*. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland.

Johnson, L.A.S. (1962). *Contributions from the New South Wales National* Herbarium **3** (**3**): 95-96

Maiden, J.H., and Betche, E. (1916). *Census of New South Wales Plants*. (Government Printer: Sydney.)

Makinson, R.O. (1991). *Grevillea*. In G.J. Harden (ed.), *Flora of New South Wales* 2:31-55 New South Wales University Press, Kensington.

Makinson, R.O. (1996). *Grevillea*. In N.G.Walsh and T.J. Entwisle (eds.), *Flora of Victoria* 3: 845-870, Inkata Press: Melbourne

Makinson, R.O. (1997). New segregate species and subspecies from the *Grevillea victoriae* (Proteaceae: Grevilleoideae) complex from south-east New South Wales. *Telopea* **7**, 129-138.

Makinson, R.O. (2000). *Flora of Australia*. Volume 17A, Proteaceae 2: *Grevillea*.

McGillivray, D.J. (1986). *New Names in Grevillea* (Proteaceae). (privately published: Castle Hill.)

McGillivray, D.J. & Makinson, R.O. (1993). *Grevillea (Proteaceae), a taxonomic revision*. (Melbourne University Press: Melbourne.)

Miles, J. (2001). *Vegetation of Rocky Outcrops, South East Forests National Park, Bemboka National Park*. (unpublished, consultant report for the NPWS).

Molyneux, W.M. & Stajsic, V. (2000). *Grevillea victoriae* subgroup (in part only), in R.O. Makinson, *Flora of Australia* 17A, Proteaceae 2: *Grevillea*.

Olde, P.M., and Marriott, N.R. (1995). *The Grevillea Book*, Vol 3. (Kangaroo Press: Kenhurst, N.S.W.)

Olde, P.M., and Molyneux, W.M. (1994). Delimitation of two new species from the *Grevillea victoriae* alliance (Proteaceae: Grevilleoideae). *Telopea* **5**, 781-787.

Ross, J.H. (1996). *A Census of the Vascular Plants of Victoria*. (National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra, Victoria, 3141, Australia.)

Ross, J.H. & Walsh, N.G. (2003). *A Census of the Vascular Plants of Victoria*. (National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra, Victoria, 3141, Australia.)

Willis, J.H. (1973). *A Handbook to Plants in Victoria*. Vol. 2. (Melbourne University Press: Carlton.)

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Larger is better: The effects of floral display on reproductive success in two populations of *Caladenia (Stegostyla) gracilis* R. Br.

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Abstract

Floral display can affect pollinator visitation and reproductive success. If floral display is genetically regulated and if pollinators preferentially visit some types of displays more frequently than others, then there are opportunities for selection. The effect of variable numbers of flowers in the terrestrial orchid *Caladenia (Stegostyla) gracilis* R.Br. on reproductive fitness was investigated in two populations. Fitness measures included the number of male (pollinaria removal) and female (pollinaria deposition and fruit set) reproductive successes. In both populations studied, all three fitness indices demonstrated the same trends that inflorescences with a greater number of flowers have a higher probability of having pollinaria removed, deposited and of producing fruits. This trend of increased reproductive success of plants with larger inflorescences was not expected in this mostly few-flowered clade, the Caladeniinae. If no other counter selective fitness measures are present, then inflorescences with greater number of flowers in *C. gracilis* can be expected in future generations, however, the increased fitness advantage for larger displays may be mediated by a reduction in lifetime fitness or survival of larger individuals, moreover flower number may be a response to phenotypic plasticity to environmental resources and may not be easily inherited if at all.

Introduction

Evolution is the result of a combination of preferential (natural selection) and random (genetic drift) changes among heritable variable characters in a species across generations (Endler, 1986). Morphological and genetic variations in a species are the potential source of evolutionary activity. Many species of plants have variable floral display and consequently there is an opportunity for pollinator directed selection (Williams and Conner, 2001; Kobayashi *et al.*, 1997; Worley *et al.*, 2000; Totland *et al.*, 1998).

The evolution of floral display has been studied in a number of species starting with *Asclepia* (Willson and Ratchke, 1974; Willson and Price, 1977). There has been an extensive interest in the evolution of floral display in many plants (Schemske, 1980; Kobayashi *et al.*, 1997). Orchids have been viewed as the ultimate evidence of pollinator driven evolution by many authors, starting with Darwin (1877). The floral morphology of orchids and the intricate interactions with their pollinator(s) have been described by Darwin (1877) and others for many orchid species and it is expected that floral display (number of flowers on an inflorescence) is equally driven by pollinators. Pollinator responses (positively or negatively) to floral display, morphology and colour in natural field populations have been evaluated in a number of orchids (Schemske, 1980; Gigord *et al.*, 2001; Maad, 2000; O'Connell and Johnston, 1998; see Tremblay *et al.*, 2005 for an extensive review). In an early orchid study evaluating pollinator-mediated selection, Schemske (1980) demonstrated that pollinators of *Brassovola nodosa* are preferentially attracted to larger inflorescences. The pattern observed by Schemske (1980) is not unique and has been corroborated in other studies (Montalvo and Ackerman, 1987; Aragón and Ackerman, 2001), but the pattern is not consistent for all orchid species (Meléndez-Ackerman and Ackerman, 2001; Flores-Palacios and Garcia-Franco, 2003).

In this study, the effect of pollinator-mediated selection in the terrestrial orchid, *Caladenia gracilis* R. Br. was investigated in two Victorian populations with inflorescences of one to four simultaneously open flowers. The strength of phenotypic selection was indicated as relative measures of male and female reproductive success.

Methods

MODEL SYSTEM

Caladeniinae is a large group of Australian terrestrial orchid taxa that recently received intensive taxonomic and systematic attention (Hopper and Brown, 2000; 2001; Jones *et al.*, 2001; Clements *et al.*, 2002) resulting in a much narrower circumscription of *Caladenia*. Most of the taxa in the Caladeniinae are few-flowered with one to six flowers per inflorescence (Backhouse and Jeanes, 1995), however the smaller inflorescences are most common and uni-flowered inflorescences are present in all of the species. Adding the floral display size of the different species of *Caladenia* studied by Jones *et al.* (2001) to their phylogenetic tree suggest that the evolutionary direction of floral display size across *Caladenia* s.l. does not show any clear patterns of increase or decrease (data not shown). However the information on display size is less than satisfactory as in the species description the range of flower size is given and not its relative importance.

Caladenia gracilis is a widespread endemic species to eastern Australia, including Victoria, South Australia, Tasmania, New South Wales, ACT and Queensland (Backhouse and Jeanes, 1995). Plants are usually found in poor soils in open woodlands and heaths (Backhouse and Jeanes, 1995). Flowers are small, 30 mm across on an inflorescence up to 45 cm tall. Bishop (1996) mentions that plants can have up to 6 flowers although none that size were seen in this survey.

SITES

A total of 81 plants was surveyed from two sites on the 19th October 2004. Thirty-nine plants from Boomers Nature Conservation Reserve (37° 38"S 145° 16"E) and 42 plants from One Tree Hill Nature Conservation Reserve (near Bendigo, Victoria; 36° 48"S 144° 19"E) were surveyed for pollinaria deposition, removal and fruit set. The selection of plants follows a non- random survey along both sides of the pathways at both sites.

STATISTICS

Total reproductive success of *Caladenia gracilis* at the species level and for each site was evaluated from percent pollinaria removal, deposition and fruit set. Differences within and among sites were tested with Kruskal-Wallis non-parametric test. Logistic regressions were used to evaluate if plants with larger floral display have preferential reproductive success through male fitness (pollinaria removal: PR) or female fitness (pollinaria deposition: PD and fruit set: FR). Population level reproductive success was calculated as the total pollinaria removed, pollinaria deposited and fruit set over total flowers surveyed. To evaluate the selective advantage of differential floral display three relative fitness indices were calculated for each individual. These indices compare the individual fitness to the mean population fitness as a function of pollinaria removal (PR), $Fitness_{PR} = \frac{PR}{Mean\ (PR)}$, pollinaria deposition on stigma (PD), $Fitness_{PD} = \frac{PD}{Mean\ (PD)}$, and fruit set . $Fitness_{PR} = \frac{PR}{Mean\ (PR)}$ Relative fitness is a measure of the contribution of the specific variable trait to the next generation as compared to the other variables and is the preferential method for estimating fitness differences among phenotypes (Lande and Arnold, 1983; Endler, 1986; Bennington and McGraw 1995).

Results

SPECIES LEVEL REPRODUCTIVE SUCCESS

A total of 160 flowers from 81 individuals was examined of which 40 flowers had their pollinaria removed (25%), while only 21 flowers were observed with pollinaria deposited on the stigma (13.1%) and 24 fruits were observed (15%). Assuming that all flowers with pollinaria deposited produce viable fruits and all fruits attain maturity, a total of 45 flowers would produce fruits, bringing fruit set to 28.1%.

FREQUENCY OF FLORAL DISPLAY SIZE

Display size of four flowers on an inflorescence was uncommon (5%) while most plants had only one (27.2%) or two flowers (53.1%;). The frequency distribution of floral display per plant was not significantly dependent on the site (Log Likelihood 2.19, df, 3, 75, p = 0.22; Fig. 1).

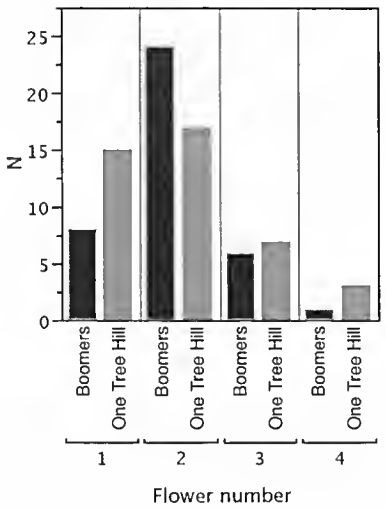

Figure 1: Frequency distribution of floral display in 81 individuals at two Victorian sites, One Tree Hill and Boomers Nature Conservation Reserves. N = number of individuals.

POPULATION VARIATION IN REPRODUCTIVE SUCCESS

The orchids surveyed at Boomers Nature Conservation Reserve and One Tree Hill Nature Conservation Reserve had significantly different levels of pollinaria removal, deposition and fruit set. However, the pattern was not consistent between sites. Pollinaria removal and deposition was higher at One Tree Hill Reserve while fruit set was higher at Boomers Reserve (Table 1).

Table 1: The number of plants and flowers surveyed, mean flowers per plant, mean pollinaria removal, deposition and fruit set at Boomers and One Tree Hill Nature Conservation Reserves. All tests performed with non-parametric Kruskall-Wallis test. NS = not significant.

	Boomers Reserve	**One Tree Hill**	**Test of Significance**
Number of plants	39	42	
Number of flowers	78	82	
Mean number of flowers per plant ± s.e.	2.0 ± 0.11	1.95 ± 0.14	NS
Mean number of pollinaria removed per plant ± s.e. (Number of male success)	0.28 ± 0.09 (11)	0.71 ± 0.15 (29)	Z = 2.32, p = 0.02
Mean number of pollinaria deposited per plant ± s.e. (Number of female success)	None (0)	0.51 ± 0.12 (21)	Z = 4.14, p < 0.0001
Mean number of fruits per plant ± s.e. (Number of female success)	0.49 ± 0.13 (19)	0.12 ± 0.05 (5)	Z = 2.44, p = 0.014

DISPLAY SIZE AND REPRODUCTIVE SUCCESS

The reproductive success through male and female indices is influenced by the display size. Plants with fewer flowers were significantly less likely to get effectively visited, either through pollinaria removal, pollinaria deposition or fruit production (Table 2). All three reproductive indicators showed a substantial increase with larger floral display. The effect of floral display was especially evident when pollinaria removal was considered; a plant with one flower had less than 10% probability of having the pollinaria removed while a plant with three flowers had close to 80% of the flowers with pollinaria removed. The reproductive indices of pollinaria deposition and fruit set also showed that a small display sizes are less effective in attracting pollen and setting fruits (Table 2).

Table 2: The observed mean ± standard error of pollinaria removed (PR), pollinaria deposited (PD) and fruits set (FR) per plant in *Caladenia gracilis* varying in number of flowers per plants. Relative fitness (RF) measure is an index of realized proportional number of PR, PD and FR success as compared to the mean fitness of the population.

Number of flowers (Sample size)	Mean PR	Mean PD	Mean FR	RF (PR)	RF (PD)	RF (FR)
1 (22)	0.09 ± 0.14	0.09 ± 0.29	0.09 ± 0.29	0.18 ± 0.13	0.35 ± 0.24	0.29 ± 0.21
2 (43)	0.44 ± 0.01	0.20 ± 0.46	0.20 ± 0.40	0.93 ± 0.21	0.74 ± 0.27	0.66 ± 0.21
3 (14)	0.79 ± 0.17	0.54 ± 0.88	0.92 ± 1.04	1.54 ± 0.46	2.05 ± 0.93	3.12 ± 0.97
4 (4)	2.25 ± 0.33	1.00 ± 1.41	0.50 ± 1.00	4.50 ± 1.26	3.81 ± 2.69	1.69 ± 1.69

Display size positively affected male reproductive success, with larger displays having had significantly greater proportion of pollinaria removed (Logistic regression; log Likelihood = 8.134, df = 1, 80, $p < 0.0001$, $R^2 = 15.7\%$), while both female reproductive success indices showed a positive response with display size, however, these models explained less of the variation (Pollinaria deposition, Logistic regression; log Likelihood = 2.37, df = 1, 80, $p < 0.03$, $R^2 = 6.1\%$; Fruit set, Logistic regression; log Likelihood = 2.998, df = 1, 80, $p < 0.01$, $R^2 = 7.0\%$). Plants with a smaller display size (1 flower per inflorescence) are expected to have only about 10% reproductive success (for male and female success), while 30% of those with a display size of three or more flowers, should have female reproductive success and more than 60% are expected to have male reproductive success (Table 3).

Table 3: The expected male and female reproductive success of individuals of *Caladenia gracilis* with varying floral display. Analysis of receiver operating characteristics (ROC) calculates the most likely state of each of the type of floral display from the logistic regression equation. Thus a flower on a two-flowered inflorescence has a 32% chance of having the pollinaria removed, while on a four-flowered inflorescence, an individual flower has an 89% chance of having the pollinaria removed.

Floral display (number of flowers)	Expected percent pollinaria removal	Expected percent pollinaria deposition	Expected percent Fruit set
1	0.11	0.09	0.10
2	0.32	0.17	0.21
3	0.66	0.30	0.37
4	0.89	0.47	0.57

Table 4: Effect of floral display on reproductive success in orchids. "+" = positive effect of larger floral display on reproductive success, "-" = negative effect of larger floral display on reproductive success, NS = no significant effect of floral display on reproductive success.

Species	Variation in number of flowers	Pollinaria removal	Fruit set	References
Aspasia principissa	1-7	+	+	Zimmerman and Aide, 1989
Brassavola nodosa	1-5	+	+	Schemske, 1980; Murren and Ellisson, 1996
Calopogon tuberosus	1-10		NS	Firmage and Cole, 1988
Comparettia falcata	1-9	+	+	Rodríguez *et al.*, 1992
Cyclopogon cranichoides	8 - > 40		+	Calvo, 1990
Dactylorhiza maculata	Mean 15		NS	Vallius, 2000
Encyclia krugii	1-8	NS	NS	Ackerman, 1989
Epidendrum exasperatum	6-358	+		Calvo, 1990
Epipactis helleborine	15-30? data absent from paper	+	+	Ehlers, *et al.*, 2002
Ionopsis utricularioides	1-44	-	-	Montalvo and Ackerman, 1987
Lepanthes woodlandii	1-123		NS	Calvo, 1990
Oeceoclades maculata	4-16		NS	Calvo, 1990
Platanthera bifolia	10-20	+	+	Maad, 2000

Discussion

Floral display in *C. gracilis* is skewed towards few flowers per individual and plants with more flowers have significantly greater reproductive success as measured from pollinaria removal, pollinaria deposition or fruit set. If floral displays were controlled only by genetics, and resources and the environment had no effect or interaction with genetics (phenotypic plasticity), we would expect a sufficiently fast rate of evolution to large inflorescences within a few generations. However, inflorescence size is likely to be at least partially controlled by nutrient and water availability and vary with site and temporal variations in biotic and abiotic resources.

The increase in reproductive success with larger flower display is not present in all orchids. In the Australian *Elythranthera brunonis* (Endl.) A.S. George no effect of single flowered versus multi-flowered individuals on reproductive success (PR and PD) was noted (Tremblay *et al.* unpublished data).

INFLUENCES ON INFLORESCENCE SIZE

Inflorescence size may be controlled by multiple factors over ecological and evolutionary time. Total flower production is dependent on plant size in many species (Harper, 1977) including orchids (Montalvo and Ackerman, 1987; Zimmerman and Aide, 1989; Calvo, 1990). Larger inflorescences including larger displays in orchids generally have greater male and female reproductive success. Moreover, plant size distribution in many populations is strongly hierarchical, with the majority of the individuals being small (Weiner and Solbrig, 1984; Gregg, 1991; Leeson, *et al.*, 1991; Montalvo and Ackerman, 1987). Consequently, most orchids have relatively small inflorescences (e.g., Schemske, 1980; Firmage and Cole, 1988, Tremblay and Ackerman, 2001) as has been shown here in *C. gracilis*. Even if larger inflorescences are beneficial, an increase in the mean inflorescence size of a population may be limited by energetic and allometric constraints. What the genetic constraints to floral display are is not evident, and what the importance of phenotypic plasticity in orchids still needs much study.

Alternatively, evidence is known that larger individuals frequently have better quality offspring (Roach and Wulff, 1987; Rossiter 1996; Weiner *et al.*, 1997). However, the effect of display size is not consistent among plant species, an experimental manipulation of inflorescence size (number of flowers) of varying fitness measures in *Ipomopsis aggregata* showed that although larger displays did attract more visits, they found no evidence that there was a proportional increase in visitation rates and found no effect on seed production (Brody and Mitchell 1997). The effect of maternal quality can have long lasting effect on to final plant size and probability of survival of the progeny (Simons and Johnston 2000).

SELF-INCOMPATIBILITY AND INBREEDING

Another factor that may impose limits to inflorescence size is the frequency of geitonogamous pollinations (Ackerman, 1989), which may be greater in larger inflorescences and result in higher rates of flower and fruit abortion due to self-incompatibility or inbreeding (e.g., Wyatt, 1982; Hessing, 1988; Klinkhamer and de Jong, 1993). Thus increased geitonogamy may result in inbreeding depression, which could counteract the positive effect of larger floral displays (increased fruit set).

COST OF FLOWERING AND REPRODUCTION

The selection advantage for larger displays in *C. gracilis* would suggest evolution towards larger inflorescences, however constraints to floral display may limit selection. If there is a cost to producing larger inflorescences or more fruits, the total lifetime reproductive success of larger plants may be less than smaller individuals if larger plants have higher probability of mortality. In orchids the cost of reproduction is almost always observed among reproductive bouts, in that in the following year plants are frequently smaller (see Tremblay *et al.* 2005 for a review). In terrestrial orchids plants may stay dormant and not emerge in the subsequent season(s) after expending energy for reproduction. For example, in the Australian *Prasophyllum correctum* D. L. Jones, flowering individuals have a 45% chance of going dormant (non-emergent) after a flowering year and only 15-20% chance of flowering during two subsequent years (Coates, *et al.*, in press). In the Estonian *Orchis ustulata* L. flowering individuals usually go dormant (57%) after flowering in the previous year and only 27% flower successively (Tali, 2002). In *Caladenia versicolor* G.W. Carr, a species related to *C. gracilis*, there appears to be a substantial cost to flowering as only 35% of flowering individuals in one year produce flowers the following year, while 53% come back as vegetative plants or are dormant (12%, unpublished data, R. Cousens). Thus the advantage of larger displays in one reproductive bout may result in a little or no reproductive success in the following reproductive bout, in consequence the lifetime reproductive success of individuals need to be evaluated to comprehend the importance of larger displays on reproductive success.

A literature review of some of the evidence of the effect of floral display on reproductive success in orchids suggests, that in most species, reproductive success is higher in larger inflorescences. Only in one species has significant negative selection been noted (*Ionopsis utricularioides*, Montalvo and Ackerman, 1987). However, in a number of orchid species pollinators appear to have no preference for floral display size (Table 4). The ability to detect a significant effect is sample size dependent, however there is no evidence to suggest that these non-significant results are an aberration. Moreover, the effect of reproductive success on floral display can be inconsistent among time and space (Maad, 2000; Ehlers et al, 2002).

To evaluate the potential for natural selection on floral display a number of parameters need to be evaluated. Do flowering individuals come back with the same number of flowers as previous flowering events Is the lifetime reproductive success of a large individual equal to small individuals? What is the importance of phenotypic plasticity on floral display? At present those data are generally missing from the literature for terrestrial and epiphytic orchids.

Conclusion

Larger floral display size for an infloreseence seems to have an evolutionary advantage in the orchid *C. gracilis*. If this evolutionary advantage has been present prior to this study, then why are larger infloreseences not more common? Constraints to display size and its evolution must be present in this system and could be influenced by complex heritability, inbreeding depression, costs to reproduction and phenotypic plasticity.

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References

Ackerman, J.D. 1989. Limitations to sexual reproduction in *Encyclia krugii* (Orchidaceae). *Systematic Botany* **14**: 101-109.

Aragón, S. and Ackerman J.D. 2001. Density effects on the reproductive success and herbivory of *Malaxis massonii*. *Lindleyana* **16**: 3-12.

Backhouse, G. and Jeanes, J. 1995. *The Orchids of Victoria*. Melbourne University Press, Carlton, Victoria, Australia.

Bennington C. and McGraw J. 1995. Phenotypic Selection in a Artificial Population of *Impatiens pallida*: The Importance of The Invisible Fraction. *Evolution* 49: 317-324.

Bishop, T. 1996. Field Guide to the orchids of New South Wales and Victoria. University of New South Wales Press, Sydney.

Brody A.K. and Mitchell, R.J. 1997. Effects of experimental manipulation of inflorescence size on pollination and pre-dispersal seed predation in the hummingbird-pollinated plant *Ipomopsis aggregata*. Oecologia **110**:86-93.

Calvo, R.N. 1990. Four-year growth and reproduction of *Cyclopogon cranichoides* (Orchidaceae) in South Florida. *American Journal of Botany* **77**: 736-741.

Clements, M.A., Jones, D.L., Sharma, I.K., Nightingale, M.E., Garratt, M. J., Fitzgerald, K.J., Mackenzie, A.M. and Molloy, B.P.J. 2002. Phylogenetics of Diurideae (Orchidaceae) based on the internal transcribed spacer (ITS) regions of nuclear ribosomal DNA. *Lindleyana* **17**: 135-171.

Coates, F., Lunt I.D. and Tremblay, R.L. In press. The effect of fire, rainfall and herbivory on emergence and flowering in a threatened terrestrial orchid from south-eastern Australia, *Prasophyllum correctum* D.L. Jones, and implications for grassland habitat management. *Biological Conservation*.

Darwin, C. 1877. *The various contrivances by which orchids are fertilized by insects*. University of Chicago Press (1984 ed.) Chicago.

Ehlers, B.K., Olesen, J.M. and Agren, J. 2002. Floral morphology and reproductive success in the orchid *Epipactis helleborine*: regional and local across-habitat variation. *Plant Systematics and Evolution* **236**: 19-32.

Emms, S. K. 1993. On measuring fitness gain curves in plants. *Ecology* **74**: 1750-1756.

Endler, J.A. 1986. *Natural Selection in the Wild*. Princeton University Press, Princeton, New Jersey.

Firmage, D.H. and Cole, F.R. 1988. Reproductive success and inflorescence size of *Calopogon tuberosus* (Orchidaceae). *American Journal of Botany* **75**: 1371-1377.

Flores-Palacios, A. and Garcia-Franco, J.G. 2003. Effects of floral display and plant abundance on fruit production of *Rynchola elia glauca* (Orchidaceae). *Revista de Biología Tropical* **51**: 71-78.

Gigord, L.D.B., MacNair, M.R. and Smithson, A. 2001. Negative frequency-dependent selection maintains a dramatic flower color polymorphism in the rewardless orchid *Dactylorhiza sambucina* (L.) Soò. *Proceedings of the National Academy of Science* **98**: 6253-6255.

Gregg, K.B. 1991. Variation in behaviour of four populations of the orchid *Cleistes divaricata*, an assessment using matrix models. Pages 139-160 In: Wells TCE, Willems JH, eds. *Population Ecology of Terrestrial Orchids*. SPB Academic Publishing bv, The Hague.

Harper, J.L. 1977. *Population biology of plants*. Academic Press.

Hessing, M.B. 1988. Geitonogamous pollination and its consequences in *Geranium caespitosum*. *American Journal of Botany* **75**: 1324-1333

Hopper, S.D. and Brown, A.P. 2000. New genera, subgenera, combinations, and species in the *Caladenia* alliance (Orchidaceae: Diurideae). *Lindleyana* **15**: 120-126.

Hopper, S.D. and Brown, A.P. 2001. Contributions to Western Australian Orchidology: 2. New taxa and circumscriptions in *Caladenia* (Spider, Fairy and Dragon Orchids of Western Australia). *Nuytsia* **14**: 27-307.

Jones, D.L., Clements, M.A., Sharma I.K. and Mackenzie, A.M. 2001. A new classification of *Caladenia* R. Br. (Orchidaceae). *The Orchadian*. **13**: 389-417.

Klinkhamer, P.C.L. and de Jong, T.J. 1993. Attractiveness to pollinators: a plant's dilemma. *Oikos* **66**: 180-184.

Kobayashi, S., Inoue, K. and Kato, M. 1997. Evidence of pollen transfer efficiency as the natural selection factor favoring a large corolla of *Campanula punctata* pollinated by *Bombus diversus*. *Oecologia* **111**: 535-542.

Lande A. and Arnold J. 1983. The measurements of selection on correlated characters. *Evolution*. 37: 1210-1226.

Leeson, K., Haynes, C. and Wells, T.C.E. 1991. Studies of the phenology and dry matter allocation of *Dactylorhiza fuchsii*. pp. 125-138. In: Wells T.C.E., Willems J.H., eds. *Population Ecology of Terrestrial Orchids*. SPB Academic Publishing bv, The Hague.

Maad, J. 2000. Phenotypic selection in hawkmoth-pollinated *Platanthera bifolia*: Targets and fitness surfaces. *Evolution* **54**: 112-123.

Meléndez-Ackerman, E.J. and Ackerman, J.D. 2001. Density-dependent variation in reproductive success in a terrestrial orchid. *Plant Systematics and Evolution* **227**: 27-36.

Montalvo, A.M. and Ackerman, J.D. 1987. Limitations to fruit production in *Ionopsis utricularioides*. *Biotropica* **19**: 24-31.

Murren, C.J. and Ellison, A.M. 1996. Effects of habitat, plant size, and floral display on male and female reproductive success of the neotropical orchid *Brassavola nodosa*. *Biotropica* **28**: 30-41.

O'Connell, L.M. and Johnston, M.O. 1998. Male and female pollination success in a deceptive orchid, a selection study. *Ecology* 79: 1246-1260.

Piper, J.G. and Waite, S. 1988. The gender role of flowers of broad leaved helleborine, *Epipactis helleborine* (L.) Crantz (Orchidaceae). *Functional Ecology* **2**: 35-40.

Roach, D.A. and Wulff, R.D. –1987. Maternal Effects in Plants. *Annual Review of Ecology and Systematics* **18**: 209-235

Rodríguez-Robles, J.A., Meléndez, E.J. and Ackerman, J.D. 1992. Effects of display size, flowering phenology, and nectar availability on effective visitation frequencies in *Comparettia falcata* (Orchidaceae). *American Journal of Botany* **79**: 1009-1017.

Rossiter, M. C. 1996. Incidence and consequences of inherited environmental effects. *Annual Review of Ecology and Systematics* **27**: 451-476.

Schemske, D.W. 1980. Evolution of floral display in the orchid *Brassavola nodosa*. *Evolution* **34**: 489-493.

Simons A.M. and Johnston, M.O. 2000. Variation in seed traits of *Lobelia inflata* (Campanulaceae): sources and fitness consequences. *American Journal of Botany* **87**: 124-132.

Snow, A.A. and Whigham, D.F. 1989. Cost of flower and fruit production in *Tipularia discolor*. *Ecology* **70**: 1286-1293.

Tali, K. 2002. Dynamics of *Orchis ustulata* population in Estonia. Ed. P. Kindlmann, Willems, J.H. and Whigham, D.F. In: *Trends and fluctuations and underlying mechanisms in terrestrial orchid populations*. pp. 33-42. Backhuys Publishers, Leiden, The Netherlands.

Totland, O., Andersen, H.L., Bjelland, T., Dahl, V., Eide, W., Houge, S., Pedersen, T.R. and Vie, E.U. 1998. Variation in pollen limitation among plants and phenotypic selection on floral traits in an early-spring flowering herb. *Oikos* **82**: 491-501.

Tremblay, R. L., Ackerman J. D., Zimmerman, J. K. and Calvo, R. 2005. Variation in Sexual Reproduction in Orchids and its evolutionary Consequences: A Spasmodic Journey to Diversification. The Biological Journal of the Linnean Society, **84**: 1-54.

Tremblay, R.L., and Ackerman, J.D. 2001. Gene flow and effective population size in *Lepanthes* (Orchidaceae): a case for genetic drift. *Biological Journal of the Linnean Society* **72**: 47-62.

Vallius, E. 2000. Position-dependent reproductive success of flowers in *Dactylorhiza maculata* (Orchidaceae). *Functional Ecology* **14**: 573-579.

Weiner, J. Martinez, S. Mueller-Schaerer, H. Stoll, P. Schmid, B. 1997. How important are environmental maternal effects in plants? A study with *Centaurea maculosa*. *Journal of Ecology* **85**: 133-142.

Weiner, J. and Solbrig, O.T. 1984. The meaning and measurement of size hierarchies in plant populations. *Oecologia* **61**: 1237-1241.

Williams, J.L. and Conner, J.K. 2001. Sources of phenotypic variation in floral traits in wild radish, *Raphanus raphanistrum* (Brassicaceae). *American Journal of Botany* **88**: 1577-1581.

Willson, M.F. and Price, P.W. 1977. Evolution of inflorescence in *Asclepias* (Asclepiadaceae). *Evolution* **31**: 495-511.

Willson, M.F. and Ratheke, B.J. 1974. Adaptive design of floral display in *Asclepias syriaca* L. *American Midland Naturalist* **92**: 47-57.

Worley, A.C., Baker, A.M., Thompson, J.D. and Barrett, S.C.H. 2000. Floral display in *Narcissus*: Variation in flower size and number at the species, population, and individual levels. *International Journal of Plant Science* **161**: 69-79.

Wyatt, R. 1982. Inflorescence architecture: how flower number, arrangement, and phenology affect pollination and fruit-set. *American Journal of Botany* **69**: 585-594.

Zimmerman, J.K. and Aide T.M. 1989. Patterns of fruit production in a neotropical orchid: pollinator vs. resource limitation. *American Journal of Botany* **76**: 67-73.

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A new species of *Commersonia* (Malvaceae *s.l.*), from the Eyre Peninsula, South Australia.

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Abstract

Commersonia multiloba C.F.Wilkins & Whitlock is described as new and illustrated. It is restricted in distribution and apparently confined to two populations on the northern Eyre Peninsula in South Australia and regarded as a species with special conservation needs.

Introduction

No comprehensive treatments of *Commersonia* J.R.Forst.& G.Forst. (1775) or *Rulingia* R.Br. (1820) have been published since Bentham (1863). There are 11 currently recognised species of *Commersonia* in Australia (Hnatiuk 1990), with one of these also occurring in SE Asia and islands of the Indo-Pacific, and 23 species of *Rulingia* in Australia (Hnatiuk 1990), plus one in Madagascar. Twenty-two of the 34 species in the two genera occur in Western Australia. *Rulingia* is currently delimited from *Commersonia* by having one rather than three staminodes between the stamens. However, taxonomic confusion between the two genera exists. Many species described as *Commersonia* were later placed under *Rulingia* (e.g Turczaninow 1849). Conversely, Mueller, in his *Systematic Census of Australian Plants* (1882, 1889), combined all species of the two genera under the previously described *Commersonia*. His generic concept was not generally accepted.

There is doubt as to separating *Commersonia* and *Rulingia*. Although these genera together form a monophyletic group, as shown by cladistic analyses of morphological data of the Lasiopetaleae (Wilkins 2002) and recent studies of *ndh*F molecular data (Whitlock *et al.* 2001), the species are intermingled and neither genus is monophyletic as currently delimited. However, only a few species of each genus were included in each analysis and current studies by Wilkins and Whitlock aim to include all species, to further test this result.

Commersonia multiloba, the species here described as new, is endemic to the northern area of Eyre Peninsula in South Australia. It is described prior to publication of a revision of the genus for the *Flora of Australia* (Wilkins in prep.) as it will be nominated as having priority needs for conservation.

Methods

Collections from AD, BM, K, MEL, NSW, NT, PERTH and W herbaria have been examined in this study, including type specimens of *C. tatei* F. Muell. ex Tate and of another closely related species *C. crispa* Turcz. The authors have collected and studied the habit and morphological characters of *C. multiloba* in its natural habitat. Floral measurements are from rehydrated herbarium collections and vegetative measurements are from dried specimens. Density of leaf hairs is defined as scattered when the hairs are well separated, moderately dense when the hairs are just touching laterally, dense when the hairs strongly overlap with the epidermis remaining visible, and a tomentose surface

where hair density is such as to conceal the epidermis. Fruit measurements include the length of the setae on the outer surfaces.

The distribution map was compiled from the Online Map Creation internet site (http://www.aquarius.geomar.de/omc_intro.html) that uses GMC software.

Taxonomy

Commersonia multiloba C.F.Wilkins & Whitlock, *sp. nov.*

C. tatei F. Muell. ex Tate affinis sed foliis ovatis marginibus multi-lobatis serratis non obovatis ad apice trilobatis, pedicellis infra pilos glandulis inconspicuis brevibus non glandulis longe-stipitatis conspicuis.

Type: Australia: South Australia: On Lincoln Hwy, NNE of Cowell (precise locality withheld), 21 Sept. 2004, *C.F. Wilkins & B.A. Whitlock 1933*; (holotype: AD 182018; isotypes: CANB, K, PERTH).

Commersonia tatei auct. non F.Muell. ex Tate: Jessop, *Fl. S. Austral.* edn 4, 2: 849 (1986) *p.p.* (as to "larger leaved form", Fig. 442A).

Dwarf shrub, 15–50 x 30–100 cm, clonal growth observed from rhizomes, shortly single-stemmed, then many spreading, recurved branches. *Young stems* with scattered, short-stalked, or sessile, 8–12 erect-armed, either ferruginous or white with tan-centre, stellate hairs, 0.5–1.3 mm diam., over dense, sessile, white stellate hairs 0.2–0.8 mm diam., and inconspicuous, white, clavate glands 0.1 mm long; stem becoming red-brown or grey, glabrous with longitudinal, irregular, fine ridging. *Stipules* caducous, narrowly-lanceolate, margin irregular, rarely bifid, 1.0–5.3 x 0.2–0.7 mm, inner surface with scattered, 1–3 -armed, appressed white hairs, to 0.5 mm long, and scattered to moderately dense clavate glands to 0.2 mm long; outer surface with moderately dense, 8–14 erect-armed, white stellate hairs, 0.1–0.5 diam. *Leaves* of differing sizes in fascicles of 4–7; petioles 0.3–5.5 mm long, hairs as on young stem; blade ovate, 1.5–20.0 x 1.2–7.5 mm, asymmetric at base; adaxial surface with dense hairs or tomentose surface, hairs sessile, 6–12 -armed, erect, white, short, stellate, hairs to 0.1–0.25 mm diam. and occasional larger stellate hairs towards margin, with arms to 0.8 mm long; abaxial surface with scattered, 12–24 erect-armed, ferruginous, stellate hairs, to 1.0 mm diam., over a tomentose surface of sessile, 12-armed, erect, white, stellate hairs to 0.2 mm diam.; margin irregularly serrate, undulate, with lobes recurved, apex obtuse. *Inflorescence* leaf-opposed, mainly terminal cymes, 6.5–13.5 mm long, flowers 1–5 (6). *Bud* base attenuate, brown; apex acute, white. *Peduncle* 2.2–6.8 mm long. *Pedicel* 2.3–5.0 mm long. Peduncle and pedicel with dense, sessile, 6–12 -armed, stellate hairs, erect, tan, or white with tan centres, over white stellate hairs 0.2–0.7 mm diam. and scattered, white, clavate glands to 0.15 mm long. *Bract* towards base of pedicel, narrowly-ovate, green, membranous, becoming red-brown, 1.8–4 x 0.15–0.4 mm, surfaces as in stipules above, margin irregular. *Epicalyx* absent. *Calyx* white, 4.6–9.0 mm long, tube *c.* 1/3 of total calyx length, lobes ovate, 3.1–4.9 x 1.6–3.7 mm, apex acute; adaxial surface, green, or pale pink at base, glabrous or with scattered, 1 or 2 -armed, appressed, white hairs to 0.3 mm long, and towards the margin and centre of lobes with dense, 1–4 -armed, erect, white, stellate hairs, to 0.15 mm diam.; abaxial surface with 8–12 -armed, erect, stellate hairs, base tomentose with moderately dense, ferruginous, stellate hairs, 0.8–1.0 mm diam. over dense, white, stellate hairs to 0.3 mm diam., and scattered, stalked, clavate glands to 0.2 mm long, and towards apex of lobe, dense, white, stellate hairs to 0.3 mm diam. *Petals* glabrous, white with red base and central streak of red, 2.6–4.2 x 2.6–3.0 mm, base ovate, incurved around stamen but not gibbous, margin of base cucullate; apical ligule spathulate, white, 1.7–2.3 x 0.9–1.2 mm. *Staminal tube* glabrous, 0.25–0.3 mm long. *Staminodes* 3 between adjacent anthers each anther, glabrous; central staminode, white, ovate, base smooth and apical margin papillose, 1.4–3.2 x 0.6–0.9 mm, 2 lateral

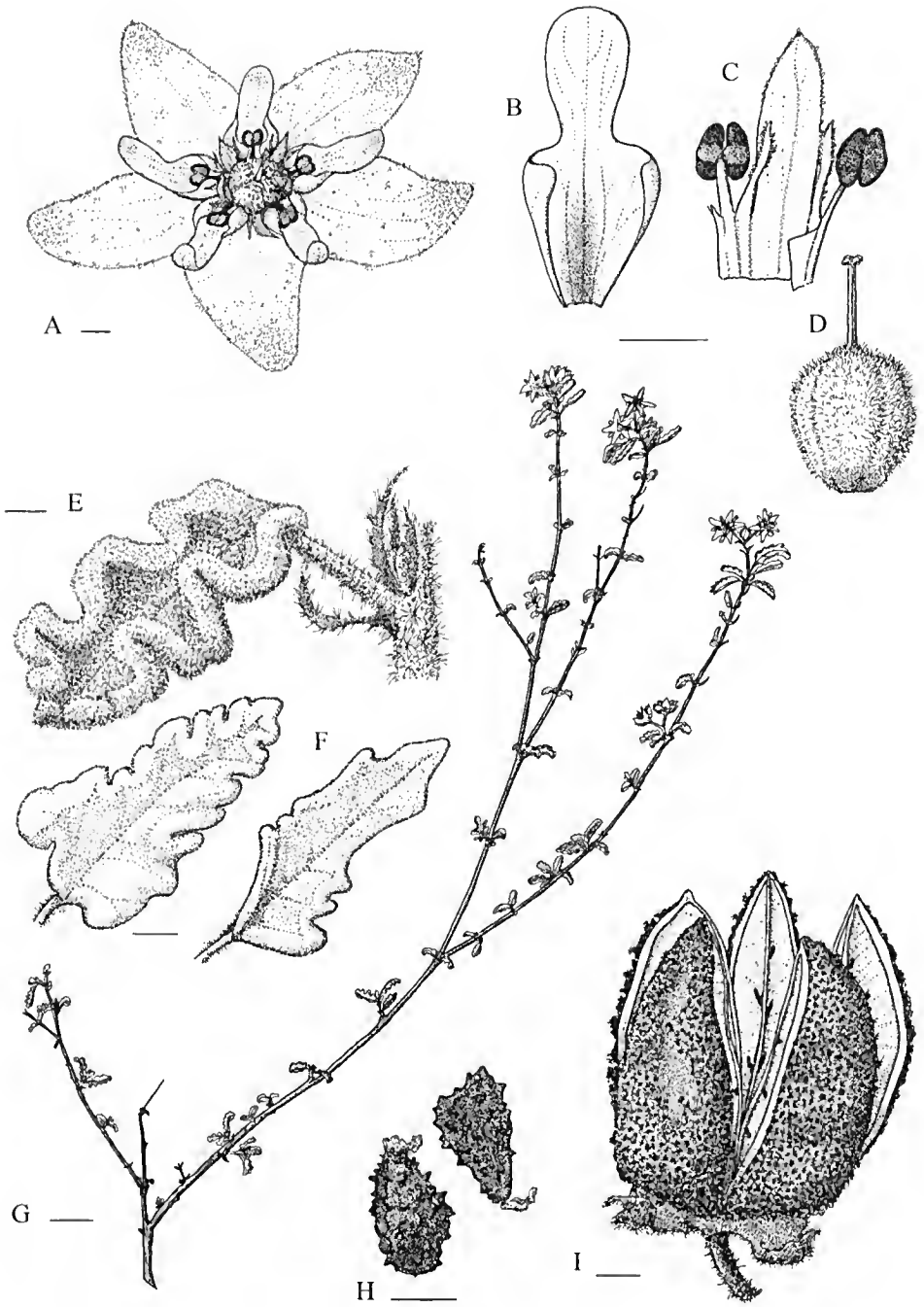

Figure 1. Illustration of *Commersonia multiloba*. A. flower. B petal. C. stamens and staminodes, D. gynoeeium. E. mature leaf and stipules. F. leaves showing unequal base. G. habit. H. seed. I. fruit with seed fallen. (Voueher C. Wilkins & B. Whitlock 1933)

staminodes linear, papillose, red, mainly adnate to the central staminode, occasionally to the anther filament, sometimes with both forms of attachment in the same flower, 0.6–1.5 x 0.1–0.15 mm. *Filaments* white, glabrous, 0.4–0.6 x 0.2 mm. *Anthers* dark red, ventrifixed, broadly-elliptic, 0.6 x 0.8–0.9 mm, dehiscence from extrorse slits, pollen yellow. *Ovary* 5-celled, ovoid to slightly obovoid, 1.0 x 0.7–1.2 mm, locules fused laterally with no indentation and free at the central axis, outer surface green with pre bristle outgrowths. *Ovules* 6–10 per cell. *Styles* 5, green, 0.75–0.9 mm long, glabrous, free at base, fused at capitate stigmas. *Fruit* loculicidal, longer than wide, slightly obovate, or ellipsoid, brown, thin woody, 6.5–11.5 x 5.5–8.0 mm, with moderately dense, soft, white, stellate hairs covering the outer surface of fruit, below moderately dense setae (bristles with hairs) mainly towards apex of fruit, 0.2–0.5 mm long, and on carpel fusion lines to 0.9 mm long; setae brown, with an apical, white, 12–24 -armed stellate hair and 1 or 2 basal stellate hairs, wings on carpel fusion lines present or absent, 0.2–0.6 mm long. *Seed* dark brown, 1.8–2.0 x 1.3–1.4 mm, exotesta strongly tuberculate, glabrous, with fine, longitudinal ridging. *Aril* a white, translucent lobe flared from hilum *c.* 0.5 x 0.7mm (Fig. 1)

Phenology: This species is recorded as flowering from August to October.

Specimens examined: **SOUTH AUSTRALIA:** (precise localities withheld) N of Cowell, 22 Oct 1983, *J.D. Briggs1411* (AD, CANB); N of Cowell, Eyre Peninsula, 18 Aug. 1975, *P Copley 40* (AD); Thurlga Station, between woolshed and Thurlga Farm, 17 Sept. 1961, *K.D. Rohrlach 911* (AD); On Lincoln Hwy, NNE of Cowell, 21 Sept. 2004, *C.F. Wilkins1936 & B.A. Whitlock* (AD, PERTH).

Distribution: *Commersonia multiloba* is restricted in distribution to the Eyre Peninsula, and occurs from Thurlga Station in the Gawler Ranges, to NE of Cowell (Fig. 2).

Habitat: This species grows on red-brown clayey sand over granite, or white sand, in *Melaleuca* and *Acacia* shrubland, with scattered mallee and *Triodia*.

Etymology: The species epithet *multiloba* refers to the many serrate lobes on the margin of leaves. This feature distinguishes *C. multiloba* from the closely related *C. tatei* that usually has three lobes at the apex of the leaf.

Conservation status: There are two known populations of this species endemic to the Eyre Peninsula. Three collections from NNE of Cowell are probably from the same population. One is a recent collection by the authors. There are *c.* 30 plants in the area, all of which are in firebreaks, either just outside a farm fence on the road verge, or inside the fence in a farm paddock. As clonal shoots were observed to be a method of reproduction for this species in this area, it is possible these plants may all be from one parent plant. The status of the other population collected in 1961 from Thurlga Station 'between the wool shed and Thurlga farm' is unknown to the authors. This species is considered to be at risk, however, further surveys of the area are required to substantiate the authors suggested ROTAP code 3E (Briggs & Leigh 1996).

Affinity: Commersonia multiloba appears to be most closely related to *C. tatei* from which it differs in having ovate leaves with multi-lobed, serrate margins rather than obovate leaves with a tri-lobed / tri-serrate apex, bi-coloured buds with ferruginous rather than white stellate hairs on the base of the outer surface of the calyx, and in the pedicel having inconspicuous, short, white, clavate glands beneath the hairs rather than conspicuous, long-stalked, red-tipped, clavate glands. In addition, fruits of *C. multiloba* are longer than wide rather than wider than long or as wide as long in *C. tatei*. Similarities between these two species include similar shape and colour of their calyces, staminodes and petals.

Jessop (1986) suggested that the larger leaved form of *C. tatei* shared some similarity with *C. crispa* from Western Australia. *Commersonia crispa* is similar to *C. multiloba* in

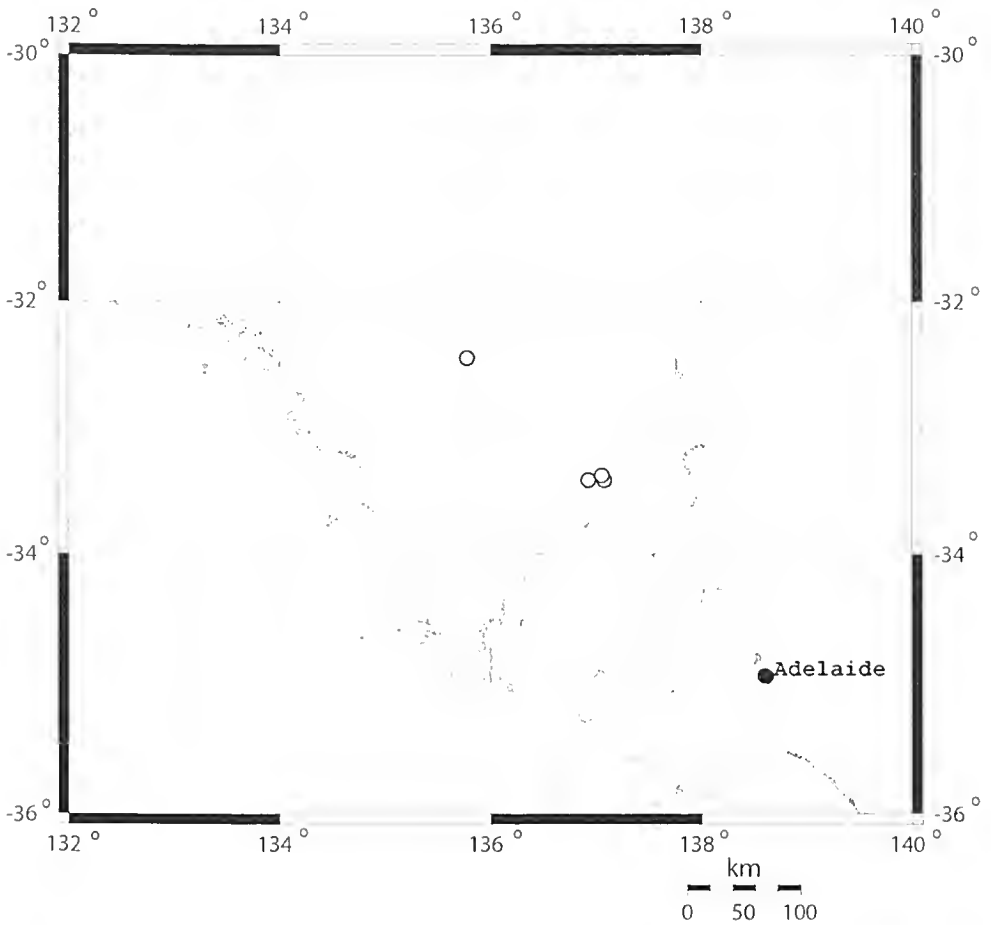

Figure 2. Distribution of *Commersonia multiloba*

having the same multilobed leaf margin, in petal and calyx shape, and in having buds with brown hairs on the base, however, the fruits of *C. crispa* have a woolly appearance due to the abundant setae up to 3.0 mm long all over the outer surface, rather than being invested with setae 0.2–0.5 mm long and mainly present on the carpel fusion lines and towards the apex of the fruit. *Commersonia crispa, C. tatei* and *C. multiloba* all have the base of the petal with a cucullate margin, a character only present in these three species.

Comment: In the Flora of South Australia (Jessop 1986), the illustration (Figure 442 A) appears to be a composite of *C. tatei* and *C. multiloba*. The drawing of the habit of the larger leaved form of plant on the left-hand side of the page resembles *C. multiloba*, however, the drawing of the twig of the right-hand side has the leaf form of *C. tatei*. The drawings of the flowers and seed (incorrectly labeled as a fruit) are consistent with both species.

There are two separate fragments on one herbarium sheet (AD 96941200), collected by Jean Galbraith from Edillilie Road on the Eyre Peninsula. The upper fragment is *C. tatei* and the lower one is *C. multiloba*. The collector noted that the lower specimen had larger leaves, slightly different vestiture, terminal flowers, and an erect, bushy habit rather than a prostrate habit as previously observed in *C. tatei*. As the distribution ranges of *C. tatei* and *C. multiloba* apparently do not overlap, the same location for both fragments attached to one sheet is questionable. Therefore, this collection site has not been included in the distribution of *C. multiloba*.

Key to *C. multiloba* and closely related species

1 Leaves ovate with multi-lobed, serrate margins; pedicel with glands absent or with inconspicuous, short, white, clavate glands beneath the hairs.
  2 Fruits with moderately dense setae 0.2–0.5 mm long, mainly present on the carpel fusion lines and towards the apex of the fruit..... .....*C. multiloba* (Eyre Peninsula, South Australia).
  2. Fruits with woolly appearance due to abundant setae, up to 3.0 mm long, present all over the outer surface of the fruit..... .....*C. crispa* (South-west of Western Australia).
1. Leaves obovate with a tri-lobed / tri-serrate apex; pedicel with conspicuous, long-stalked, red-tipped, clavate glands, as long as, or longer than the hairs. ....*C. tatei* (Eyre Peninsula, South Australia).

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References

Bentham, G. (1863). 'Stereuliaceae'. In *Flora Australiensis*. Vol. 1. L. Reeve and Co.: London.

Briggs, J.D. and Leigh, J.H. (1996). *Rare or threatened Australian plants*. Centre for Plant Biodiversity Research, Australian Nature Conservation Agency: Canberra.

Brown, R. (1820). In Sims, *J. Curtis's Botanical Magazine*, 48, t. 2191.

Forster, J.R. and Forster, J.G. in Forster, J.R. & Forster, J.G. (1775) *Characteres Generum Plantarum* ed. 1, p43, t. 22 (not cited: London).

Hnatiuk, R.J. (1990). 'Stereuliaceae'. In *Census of Australian Vascular Plants*. Australian Government Publishing Service: Canberra.

Jessop, J.P. In Jessop, J.P. and Toelken, H.R. (eds.) (1986). 'Stereuliaceae' in *Flora of South Australia* edn 4, **Vol. 2**. South Australian Government Printing Division: Adelaide.

Mueller, F. von. (1882). Sterculiaceae In: *Systematic Census of Australian Plants*, Suppl. 1–4, MeCarron Bird and Co: Melbourne.

Mueller, F. von. (1889). Sterculiaceae In: *Second Systematic Census of Australian Plants*, Part 1 MeCarron Bird and Co: Melbourne.

Turczaninow, P.K.N.S. (1846). Generum Adhuc non Descriptorum. *Bulletin de la Société Impériale des Naturalistes de Moscou* **22**, (2) 10.

Whitlock B.A., Bayer, C. and Baum, D.A. (2001). Phylogenetic relationships and floral evolution of the Byttnerioideae ("Sterculiaceae" or Malvaceae *s.l.*) based on sequences of the chloroplast gene, *ndh*F. *Systematic Botany* **26**, 420–437.

Wilkins, C.F. (2002). *A Systematic Study of Lasiopetaleae* (Malvaceae *s.l.* or Stereuliaceae). PhD thesis The University of Western Australia, Perth, Western Australia.

Muelleria 22: 93–96 (2005)

A new species of *Bulbine* (Asphodelaceae) from Wilsons Promontory and islands of eastern Bass Strait

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† D.I. Morris d. 27 July 2005

Abstract

Bulbine crassa D.I.Morris & Duretto (Asphodelaeeae), a stout perennial speeies ranging from Wilsons Promontory (Victoria) to near Cape Barren Island (Tasmania), is newly deseribed. A key to the Tasmanian and Vietorian speeies of *Bulbine* is provided.

Introduction

In 1958 Dr Mary Gillham (CSIRO) eollected a speeimen of a *Bulbine* from Anderson Island in the Furneaux Group (Tasmania). The speeimen was at that time determined as *B. semibarbata* (R.Br.) Haw. as the filaments of the stamens opposite the outer perianth segments were either bare or bore only a few hairs. It was noted that the specimen was of an 'Extra large form' easily distinguished from the normal *B. semibarbata* with which it was growing. Subsequently, more speeimens of the same type were collected from several islands of eastern Bass Strait and Wilsons Promontory in Victoria. Watson (1987) noted in the *Flora of Australia* that *B. semibarbata* was variable in habit and the size and shape of the leaves. She also noted that some plants from Tasmania and southern coastal areas of the mainland appear to be facultative perennials. *Bulbine semibarbata* usually behaves as an annual. In the *Flora of Victoria,* Conran and Walsh (1994) noted, in deseribing *B. semibarbata*, that 'A remarkable robust, fleshy and apparently perennial form oeeurs on rocky eoastal sites on Wilsons Promontory and surrounding islands and at Cape Conran in the east'. They also note that a form of *B. glauca* (Raf.) E.M.Watson, similar to the above, is largely coextensive on and near Wilsons Promontory.

These large suceulent perennials have usually been assigned to *B. semibarbata* in the past on the basis of the stamens opposite the outer perianth segments being glabrous (or nearly so) even though *B. semibarbata* normally behaves as an annual. The overall appearanee of these large, perennial plants more elosely resembles *B. glauca*.

Bulbine semibarbata is a variable species as noted by Watson (1986, 1987). Another one of the forms noted by Watson (1986, 1987) from the Pilbara Region of Western Australia has been formally described as *B. pendula* Keighery (Keighery 2004).

Taxonomy

Bulbine crassa D.I.Morris & Duretto, *sp. nov.*

Species haec a B.glauca *(Raf.) E.M.Watson differt foliis carnosioribus, scapo crassiore basi 7–10 mm diametro et filamentis staminum externorum nudis vel pilis paucis.*

Type: **TASMANIA**: FURNEAUX: Neds Reef, about 1 km off Neds Point on the north coast of Cape Barren Island, 40°20'S 148°04'E, 1 Dec. 1986, *S. Harris* (holotype: HO *312703*)

Bulbine sp. nov fide S. Harris, A. Buchanan and A. Connolly, *One Hundred Islands: The Flora of the Outer Furneaux* 122 (2001).

Illustrations: S. Harris, A. Buchanan and A. Connolly, *One Hundred Islands: The Flora of the Outer Furneaux* 122 [photograph] & 123 (2001), as *Bulbine sp. nov.*

Tufted *herb* perennating by offsets around the flowering shoot, glabrous apart from the stamens. *Roots* fleshy. *Leaves* erect, fleshy, the pith a delicate membranous honeycomb filled with a clear mucous sap, up to 50 cm long, to 2.5 cm wide at the base, plano-convex or shallowly channelled, bright green, slightly glaucous, senescent leaves red-orange, shortly persistent. *Scapes* solitary except where two or more offsets flower together, up to 60 cm tall, usually taller than the leaves, 7–10 mm diameter at the base, dried scapes from the previous year often persisting. *Inflorescence* up to 30 cm long; *bracts* lanceolate-acute, c. 7 mm long; *pedicels* c. 10 mm long. *Perianth* segments 12–13 mm long, yellow, nerve green, more prominent abaxially. *Stamens* 6; the 3 opposite the outer perianth segments c. 7 mm long, the filaments naked or with a few to many short simple hairs below the anther; the 3 opposite the inner perianth segments c. 9 mm long, the filaments with a dense beard of clavate hairs 1–1.5 mm below the anther; *anthers* 1–1.8 mm long, versatile, greenish. *Ovary* globose, c. 2 mm in diameter; *style* 2–2.8 mm long, slightly curved upwards; *stigma* shortly 3-lobed. Mature *capsule* 5–6.5 mm in diameter. *Seeds* 2–3 per locule, 3–3.5 mm long, black, narrowly winged, wrinkled.

Additional specimens examined: **VICTORIA**: WILSONS PROMONTORY: Wilsons Promontory National Park, 11 Nov. 1983, *A.C. Beauglehole ACB75403* (MEL, photograph HO); Wilsons Promontory, 39°00'S 146°25'E, 21 Nov. 1989, *E.A. Chesterfield s.n.* (MEL *2012402*, photograph HO); Notch Island, 38°56'S 146°40'E, 21 Dec. 1978, *M. Harris & D. Deerson* (MEL *593493*); Rag Island, 38°57'S 146°40'E, 21 Dec. 1978, *M. Harris & D. Deerson* (MEL *593494*); Rabbit Island, 38°31'S 146°55'E, 10 Dec. 1979, *I.F. Norman* (MEL *576432*); Wattle Island, 39°08'S 146°21'E, 12 Dec. 1979, *I.F. Norman* (MEL *576433*); Citadel Island, 39°07'S 146°14'E, *F.I. Norman & R. Brown* (MEL *593495*); Dannervig Island, Glennie Group, 39°06'S 146°14'E, 17 Jan. 1980, *I.F. Norman* (MEL *576430*); **TASMANIA**: FURNEAUX: Rodondo Island, 39°14'S 146°23'E, 13 Nov. 1984, *N.P. Brothers 64* (HO); Cone Islet, 39°30'S 146°40'E, 12 Nov. 1984, *N.P. Brothers 3* (HO); South West Island, 39°31'S 147°07'E, 11 Nov. 1984, *N.P. Brothers 306* (HO); Craggy Island, 6 Sept. 1972, *J.S. Whinray 188* (MEL); *ibid*, 39°41'S 147°41'E, 17 Dec. 1986, *S. Harris* (HO *104072*); ibid, 30 Mar. 1972, *J.S. Whinray 300a* (HO); Oyster Rocks (southern island), Anderson Group, 40°17'S 148°04'E, 2 Dec. 1986, *S. Harris* (HO *105318*); Little Woody [Anderson Island] and Mid Woody Island, Franklin Sound, 40°17'S 148°06'E, 16 Dec. 1958, *M. Gilham* (HO *114257*); Mid Woody Island, Anderson Island group, Franklin Sound, 40°18'S 148°07'E, 2 Dec. 1986, *S. Harris* (HO *103167*); Little Woody Island, 2 Nov. 2002, *S. Harris* (CANB, HO *530711*, MEL); Little Anderson Island, 40°17'S 148°06'E, 3 Jun. 2000, *A.M. Buchanan 15735* (HO); *ibid*, 40°18'S 148°07'E, 2 Dec. 1986, *S. Harris* (HO *103627*); Anderson Island, Franklin Sound, 40°19'S 148°06'E, 2 Dec. 1986, *S. Harris* (HO *107085*); Doughboy Island, 40°21'S 148°03'E, 1 Dec. 1986, *S. Harris* (HO *107778*).

Etymology: The specific epithet is the Latin *crassa*, thick, solid, referring to the fleshy leaves and the stout scape.

Notes: *Bulbine crassa* is variable in the indumentum of the outer stamens unlike other species of *Bulbine* found in Tasmania and Victoria. While in many plants the outer staminal filaments are glabrous (like *B. semibarbata*) some specimens have outer staminal filaments that have a few hairs or are quite hairy. With so few collections available and most populations known from single collections it would be premature to do more than note this variation.

Distribution: In Tasmania, *B. crassa* is found on smaller, low-lying islands of the eastern side of Bass Strait from Doughboy Island (Furneaux Group) to Rodondo Island (Anser Group): collections have been seen from the Furneaux, Kent, Curtis and Anser Groups. In addition to the localities cited above the species has been seen on Hogan Island (Hogan Group; Mark Holdsworth and Stephen Harris, pers. com.) and Erith Island (Kent Group; Beth Gott, pers. comm.). In Victoria, *B. crassa* is found on Wilsons Promontory and on nearby offshore islands including Rabbit Island, and some members of the Glennie Group, Anser Group and the Seal Islands.

Conran and Walsh (1984) indicated that the robust form of *B. semibarbata* was found at Cape Conran. There are no specimens of *B. crassa* from Cape Conran lodged at either the National Herbarium of Victoria (Neville Walsh, pers. comm.) or at the Tasmanian Herbarium.

Habitat: The species is found in areas subject to salt-laden westerly winds on loams or skeletal sandy soils overlying granite. Primarily it is found in *Poa poiformis* (Labill.) Druce tussock grassland or occasionally in coastal shrubland or mats of salt-tolerant natives (eg. with *Disphyma crassifolium* (L.) L.Bolus). Where the island has been subjected to grazing by livestock then *Lycium ferocissimum* Miers may also be present (eg. on Neds Reef and Little Anderson Island). Flowering material has been collected from September to February; fruiting material has been collected from November to February with old scapes often persisting until the next flowering season.

Conservation status: *Bulbine crassa* is found in a number of reserves. In Victoria, all known populations are in either Wilsons Promontory National Park or the Seal Island Wildlife Reserve. In Tasmania, populations are found on remote islands, some of which are reserved: the Kent Group (South West and Erith Islands) is a proclaimed national park; Doughboy (Furneaux Group), Curtis (Curtis Group) and Rodondo (Anser Group) Islands are nature reserves; and Oyster Rocks are part of a conservation area. Little information on population sizes is given with collections though on Hogan Island (Hogan Group) it was estimated that 1000's of plants were present (Mark Holdsworth and Stephen Harris, pers. com.). Some of the islands on which the species is found, e.g. South West, Curtis, Cone, Craggy and Rodondo, could be considered to be pristine (Stephen Harris, pers. comm.). Others are affected by grazing, fire and weed incursion.

Given that many of the known populations of *B. crassa* are on remote islands that are relatively pristine and/or are adequately reserved, *B. crassa* could be considered to be secure though rare. Field research is required to ascertain population sizes, identify threats and accurately determine the conservation status of *B. crassa*.

Key to the species of *Bulbine* found in Tasmania and Victoria

To include *B. crassa* in the key to the species of *Bulbine* found in Australia (Watson 1987, p. 237) insert couplet 2 (below) onwards for couplet 5.

1. Perianth segments less than 7 mm long; stamens opposite outer perianth whorl glabrous; plants annual ..... **B. semibarbata**
1. Perianth segments more than 7 mm long; stamens opposite outer perianth whorl usually bearded, sometimes sparsely so or glabrous; plants perennial 2

    2. Mature leaves flaccid, not succulent; tubers present; anthers more or less basifixed, partly obscured by hairs ..... **B. bulbosa**
    2. Mature leaves succulent; tubers absent; anthers versatile, not obscured by hairs 3

        3. Scapes 2–5.5 mm across at base; all stamens with a dense tuft of hairs .... **B. glauca**

        3. Scapes 7–10 mm across at base; stamens opposite inner perianth whorl with a dense tuft of hairs, stamens opposite outer perianth whorl glabrous or with few to many hairs ..... **B. crassa**

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References

Conran, J.G. and Walsh, N.G. (1994). *Bulbine*. *Flora of Victoria* **2**, 667–670.

Harris, S., Buchanan, A. and Connolly, A. (2001). *One Hundred Islands: the Flora of the Outer Furneaux*. Tasmanian Department of Primary Industries, Water and Environment: Hobart.

Keighery, G. (2004). A new species of *Bulbine* (Asphodelaceae) from Western Australia. *Nuytsia* **15**, 241–244.

Watson, E.M. (1986). Cytoevolutionary studies in the genus *Bulbine* Wolf (Liliacaeae). 2. The Australian annual taxa (*B. semibarbata s.l.*). *Australian Journal of Botany* **34**, 505–522.

Watson, E.M. (1987). *Bulbine*. *Flora of Australia* **45**, 236–241.

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New combinations for two species of *Spyridium* (Rhamnaceae: Pomaderreae) from the Grampians, Victoria

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Abstract

Recent molecular and morphological studies on Australian Rhamnaceae have revealed that two species of *Trymalium* Fenzl endemic to the Victorian Grampians are misplaced in the genus and should be transferred to *Spyridium* Fenzl. Two new combinations, *Spyridium daltonii* (F. Muell) J. Kellerm. and *S.* x*ramosissimum* (Audas) J. Kellerm., are provided. Lectotypes are chosen for both species.

Introduction

Spyridium Fenzl consists of approximately 40 species and occurs predominantly in southern and south-eastern Australia and Tasmania. It is one of the most diverse genera in the Australian Rhamnaceae and is currently being revised for the *Flora of Australia* (W.R. Barker, J. Kellermann, F. Udovicic & N.G. Walsh, in prep.). In Victoria the genus is represented by seven species, most of which also occur in South Australia and/or New South Wales. One species, *Spyridium* sp. 1 *sensu* Walsh (1999a), is very rare and endemic to the Little Desert.

The genus is part of the tribe Pomaderreae Reissek ex Endl., which currently contains approximately 200 species in seven genera (*Blackallia* C.A. Gardner, *Cryptandra* Sm., *Pomaderris* Labill., *Siegfriedia* C.A. Gardner, *Spyridium*, *Stenanthemum* Reissek, *Trymalium* Fenzl). Pomaderreae is characterised by the presence of a stellate indumentum on stems, leaves, and/or flowers. The tribe is endemic to Australia, with one genus (*Pomaderris*) extending to New Zealand. It is described in more detail in Medan and Schirarend (2004) and Kellermann *et al.* (2005).

Phylogenetic analyses of Pomaderreae using nuclear internal transcribed spacer DNA sequences (Kellermann *et al.* 2005) have revealed that two species from the Victorian Grampians that are currently classified as *Trymalium*, namely *T. daltonii* F.Muell. and *T.* x*ramosissimum* Audas, are misplaced in that genus and should be transferred to *Spyridium*. The Queensland species *T. minutiflorum* E.M. Ross was shown to be part of a group of species that includes taxa that were previously not thought to be related (Kellermann *et al.* 2005). This group will eventually be described as a new genus of Rhamnaceae (J. Kellermann, B.L. Rye and K.R. Thiele, in prep.). With the exclusion of these south-eastern Australian species, the genus *Trymalium* will be virtually confined to Western Australia, with one species in South Australia, *T. wayi* F. Muell. & Tate. This paper makes the relevant new combinations and lectotypifications for the Victorian species. Detailed descriptions and distribution maps are given in Walsh (1999b).

Taxonomy

Spyridium daltonii (F. Muell.) J. Kellerm. ***comb. nov.*** *Trymalium daltonii* F. Muell., *Fragm.* 9: 135 (Sept. 1875), as "*T. Daltoni*". *Cryptandra daltonii* (F. Muell) F. Muell., *Syst. census Austral. pl.* 60 (1882), as "*C. Daltoni*". *Type citation*: "In valle Barney's Gully

montium Grampians perrarum; St. Eloy D'Alton". *Lectotype* (**here designated**): Halls Gap, Grampians, 1875, *St E. D'Alton s.n.* (MEL 56063). *Remaining syntypes*: Halls Gap, *St E. D'Alton 11* (MEL 56066); Grampians, *St E. D'Alton s.n.* (MEL 56067); Victoria, from the Grampians, *St E. D'Alton s.n.* (MEL 56059, 56060; BM *n.v.*, photo seen).

Common name: Because the common name of the plant, Narrow-leaf Trymalium, includes the genus name, a change is desirable. To avoid confusion with the South Australian *S. phylicoides* Reissek, which is called Narrow-leaved Spyridium (Canning & Jessop 1986), an alternative common name, **Grampians Spyridium**, is suggested.

Illustrations: G.R. Cochrane, B.A. Fuhrer, E.R. Rotherham and J.H. Willis, *Flowers and plants of Victoria* 48, t.109 (1986), photograph; L. Costermans, *Native trees and shrubs of south-eastern Australia* 222–223 (1981), line drawing and photograph; I.R. McCann, *The Grampians in flower* 98 (1994), photograph; N.G. Walsh and T.J. Entwisle, *Flora of Victoria* 4: 113, t. 19A (1999); M.G. Corrick and B.A. Fuhrer, *Wildflowers of Victoria* 200, t.702 (2000), photograph. All illustrations as *T. daltonii*.

Taxonomic history: Ferdinand von Mueller described *S. daltonii* in 1875 from specimens collected by St. Eloy D'Alton in the Grampians. He placed the species in *Trymalium* and described it as having linear leaves, up to 3/4 ''' (i.e., 1.5 mm) wide, with persistent stipules, cymose inflorescences with few flowers, globular flower buds, a short minutely trilobate style, and petals that contain the anthers.

Generic concepts in Rhamnaceae were very fluid at that time, with anything between two (*Cryptandra* and *Pomaderris*; Hooker 1855) and five genera (*Cryptandra*, *Pomaderris*, *Spyridium*, *Stenanthemum* and *Trymalium*; Bentham 1863) suggested for Pomaderreae (see also Thiele & West 2004, Kellermann *et al.* 2005). Mueller himself stated on the same page of the *Fragmenta* on which he published the new species that he planned to dispose of two genera, and include *Trymalium* into *Spyridium*, and *Stenanthemum* into *Cryptandra*. Seven years later Mueller followed Hooker and accepted only two genera in Pomaderreae, assigning all species of *Spyridium*, *Stenanthemum* and *Trymalium* to *Cryptandra* (Mueller 1882). Among the species he transferred to *Cryptandra* was *T. daltonii*.

Subsequent authors, however, accepted the genus *Trymalium* and the Victorian species *T. daltonii* (e.g., Ewart 1931, Willis 1972, Walsh 1999b).

Typification: There are several sheets of *S. daltonii* at MEL that were collected by St Eloy D'Alton, however, the only collection locality given on them is "Halls Gap, Grampians" or "Grampians". Barney's Gully, mentioned by Mueller, refers to Barney Creek, which is located about 8 km south-east of Halls Gap. No specimens with this location were found at K or BM. The lectotype (MEL 56063) is a flowering branch and bears a label in D'Alton's handwriting and a herbarium label by Mueller; it is the only specimen with a collection date.

One of the remaining syntypes (MEL 56067) has a label in Mueller's hand only; another specimen (MEL 56066) has a label by D'Alton with a description of habit and flower colour, in which he also stated "Fruit not procurable yet". This corresponds with Mueller's protologue, in which he writes that fruits are not known for the species. Therefore the fruiting specimen on sheet MEL 56056, which is annotated as "possible syntype", is excluded from the type series.

Three additional sheets (MEL 56059, MEL 56060; BM) have printed labels, and were presumably part of an educational set of plant specimens issued by Mueller.

Notes: In older literature, the epithet is often spelt "*D'Altonii*" or "*d'altonii*".

Spyridium* ×*ramosissimum (Audas) J. Kellerm. ***comb. nov.*** = *Spyridium parvifolium* (Hook.) F. Muell. × *S. daltonii* (F. Muell.) J. Kellerm. *Trymalium ramosissimum* Audas, *Vict. Nat.* 38: 35, t. 1 (4 Aug. 1921); name first published in *Vict. Nat.* 37: 136 (7 Apr.

1921). *Trymalium* x*ramosissimum* Audas (pro sp.) *sensu* J.H. Ross, *Census vasc. pl. Victoria*, 5th edn, 103 (1996). *Type citation*: "Grampians (Mount Difficult), C.W. D'Alton & J.W. Audas". *Lectotype* (**here designated**): Mt. Difficult, Grampians, Oct. 1919, *J.W. Audas & C.W. D'Alton s.n.* (MEL 56153). *Isolectotypes*: MEL 56154, MEL 56156. *Possible isolectotype*: Grampians 1920 [Oct. 1919], from *Audas* Feb. 1921 (MEL 688397 ex herb. A.J. Tadgell).

Common name: Two names are currently applied to the species, Broad-leaf Trymalium (Ewart 1931) and Branched Trymalium (McCann 1994). The suggested common name is **Branched Spyridium**.

Illustrations: J.W. Audas, *Vict. Nat.* 38: opp. 34, t. 1 (1921), *One of Nature's Wonderlands* 59–60, t. opp. 59 (1925), *The Australian Bushland* 283–284, t. opp. 283 (1950); L. Costermans, *Native trees and shrubs of south-eastern Australia* 222 (1981); I.R. McCann, *The Grampians in flower* 98 (1994), photograph; N.G. Walsh and T.J. Entwisle, *Flora of Victoria* 4: 113, t. 19B (1999), leaf only. All illustrations as *T. ramosissimum* or *T.* x*ramosissimum*.

Taxonomic history: James W. Audas visited the Grampians once in every year between 1912 and 1922 together with his friend Charles W. D'Alton. He reported about most of these excursions in the *Victorian Naturalist* (Audas 1913; 1914; 1919; 1920; 1921b; 1922). As such, he was very familiar with the Grampians' flora and also knew Mueller's *Trymalium daltonii*, which he mentions several times in these articles.

In November 1918 he collected some twigs of *Spyridium* x*ramosissimum* for the first time. The new species was possibly drawn to Audas' attention by D'Alton, who had collected the species before. There are two sheets of *S.* x*ramosissimum* collected by Charles [W.] D'Alton in the Grampians "prior to 1907" (MEL 56152, 235444). Audas tentatively labeled the 1918 specimen as "*Cryptandra* sp. ?". He then forwarded the material to J.M. Black in Adelaide, who identified it correctly as a *Spyridium* and supplied Audas with a description. The copiously annotated and illustrated sheet is still in Black's herbarium (AD 97015409: Grampian Mts., Vict., 1 Nov 1918, *J.W. Audas s.n.*). In a thank-you note to Black from 20 Feb. 1919 (attached to AD 97611150), Audas states: "I have written a paper on my Grampians trip for the Field Naturalist,s [*sic*] Journal and hope to include this new Spyridium". The report appeared in the *Victorian Naturalist* on 10 Apr. 1919, however, without the description of the species (Audas 1919).

On their next trip to the Grampians, in October 1919, Audas and D'Alton collected the species at Mt Difficult, but this time they gathered more material. An attempt to collect the species in the following year failed (Audas 1921b). Audas forwarded these specimens to A.J. Tadgell. Two letters from Tadgell to Audas from 8 Feb. and 21 June 1921 are attached to a herbarium sheet (MEL 688397) and give a detailed analysis and compare *Spyridium* x*ramosissimum* with *S. daltonii*. The sheet also contains the reply from Audas dated 8 Feb. 1921, in which he thanks Tadgell for his "careful overhauling of the two specimens" and hoped "in the near future to describe the plant as new to science". The new species was first presented as an exhibit at a Field Naturalists' meeting on 14 Mar. 1921 (*Vict. Nat.* 37: 136) and was published in the *Victorian Naturalist* on 4 Aug. 1921 as *Trymalium ramosissimum* (Audas 1921a). Clearly, Audas changed his mind about the generic affinity of the new species between 1919 and 1921. We do not know, whether it was through the influence of Tadgell, who saw the species to be close to *S. daltonii*. It is also uncertain why Audas states that he discovered the species in October 1919 (Audas 1921a, b), even though he had found it the year before.

Curiously, Audas published virtually the same text and illustration in two other books (Audas 1925, 1950), claiming each time that he is describing a "new species". In his 1950 book he augments it with a Latin diagnosis of the species, as was required by the *Code of Botanical Nomenclature* from 1935 onwards (Greuter *et al.* 2000). When writing the description of *S. ramosissimum* and the points of distinction between the species and *S.*

daltonii for publication, Audas relied heavily on correspondence with A.J. Tadgell and J.M. Black. The Latin diagnosis in Audas (1950) is the same as the one drafted by Black on his herbarium sheet.

Audas regarded the species as being closely allied to *S. daltonii*, mainly differing in having broader and larger leaves with less strongly revolute margins, stipules and bracts being broader in shape as well. He also described the new species to have a more wooly indumentum on the calyx lobes, and more lightly coloured, silky hairs on the stems and leaves.

Leon Costermans first suggested that the species is a hybrid between *S. daltonii* and *S. parvifolium* (Costermans 1981). Plants of *S.* ×*ramosissimum* usually grow in the vicinity of both parent species, and apparently do not set viable seed; if fruitlets are present, they are usually from "immature and/or aborted fruits" (Walsh 1999b: 110). The hybrid status of the taxon was formally recognised in Ross (1996).

Two other earlier collections of *S.* ×*ramosissimum* exist at MEL: St Eloy D'Alton sent one specimen to Mueller (MEL 56155) with the annotation "Halls Gap, not common". This specimen was presumably the reason for Mueller to amend the description of his *T. daltonii* to include leaves up to 2'" (i.e. 4.2 mm) in width in December 1875 (*Fragm.* 9: 198). A 1912 collection by P.R.H. St John from Bacchus Marsh (MEL 56069) seems to be labeled incorrectly, since the taxon is very unlikely to occur that far from the Grampians. It is not uncommon for St John specimens to have incorrectly ascribed locality information (N.G. Walsh, pers. comm.).

Typification: Four sheets at MEL are marked as possible syntypes, three of which bear the label "Mt. Difficult, Grampians" and were collected by Audas and D'Alton in October 1919. The lectotype (MEL 56153) is a flowering branch. The remaining isolectotypes consist of a vegetative specimen (MEL 56154) and two small flowering twigs (MEL 56156).

The correspondence between Tadgell and Audas is attached to sheet MEL 688397, which contains two flowering branchlets and has clearly been used to draw up the diagnosis of the species. The sheet is from Tadgell's own herbarium (a corresponding specimen of *S. daltonii*, MEL 688389, from his herbarium has a copy of the letters from 8 Feb. 1921 attached as well). The sheet is only annotated "Grampians 1920" and "from Audas Feb. 1921", which is in conflict with the date of the other isolectotypes. Helen Aston (in a note on the sheet, dated May 1987) assumes that the specimens are "probably part of the Oct. 1919 type gathering" since "Audas frequently used dates conflicting by a year or two". This assumption is corroborated by Audas' assertion that he and D'Alton were "unable to secure the smallest specimen" (Audas 1921a: 16) of *S. daltonii* during his October 1920 field trip to the Grampians. As such, the specimen could not have been gathered in 1920, but presumably the year before. Although used by Tadgell and Audas to compile the original description of the species, this sheet is not selected as the lectotype because of the lack of exact information about the collectors, location and date.

According to the label, the specimen in J.M. Black's herbarium (AD 97611150) was collected by Audas only, and not by Audas and D'Alton, as stated in the protologue. It is therefore not accepted as type material.

Discussion

The molecular systematic analysis of Kellermann *et al.* (2005) confirmed both genera, *Trymalium* and *Spyridium*, with high statistical support. The *Trymalium* clade comprised species from Western Australia and South Australia only, and was sister to the remaining genera of Pomaderreae, although this position within the tribe did not receive any statistical support above 50%. The genus *Spyridium* consisted of four subclades, containing taxa from Western Australia, Tasmania, south-eastern Australia and New South Wales. *Spyridium daltonii* and *S.* ×*ramosissimum* formed a highly supported clade, which was firmly placed within the genus *Spyridium* in the clade of south-eastern

Australian species. Chloroplast *trn*L-F sequence data also confirms the plaeement of these speeies (unpubl. results). As such the generie plaeement of *Spyridium daltouii* and *S.* x*rauuosissimum* in *Spyridium* is unambigous when using moleeular data.

Thiele and West (2004) have published diagnostie eharaeters for *Spyridium* that have helped to elarify its generie limits and relationships to other Australian genera of Rhamnaeeae. Some of the main features mentioned by the authors are the type of dise, infloreseence and disseminule, whieh are all diseussed below for *S. daltouii* and *S.* x*rauuosissimum*. Diagnostie differences between *Spyridium* and *Tryualium* are listed in Table 1.

Table 1: Diagnostie differenees between the genera *Spyridium* and *Trymalium*

Spyridium	*Trymalium*
Stipules	
Persistent, free or connate behind petiole	Deeiduous, free, sometimes overlapping behind petiole
Inflorescences	
Cymose, the eymose pattern ±maintained to the base of the infloreseenee	Cymose, the unit-eymes usually arranged raeemosely on little-branehed axes, whieh are often grouped into higher-order panieles, rarely umbellate
Floral leaves	
Often present with a dense white indumentum on the upper leaf surface, subtending the unit-eymes or the whole infloreseenee	Absent
Pedieels	
Absent or apparently so	Clearly pedieellate
Floral bracts	
Generally large, persistent, surrounding the flower heads or unit-eymes	Thin, stipule-like, eadueous, at the base of the unit-eymes
Flower colour	
White to grey	Beige to yellow
Free hypanthium tube	
Usually very short (but see Thiele & West 2004 for exceptions)	Usually absent, exeept *T. urceolare* (F. Muell.) Diels
Petals	
Cueullate, hooding and enclosing the anthers, usually ereet	Longitudinally rolled or ±flattened, spathulate, usually spreading
Style	
Entire with a minutely 3-lobed stigma	Deeply branehed, (2)3-fid
Dise	
Glabrous, shelf-like, attached to the hypanthium wall, indented adjaeent to the staminal filaments, sometimes consisting of distinet lobes	Glabrous, thickened ring immediately surrounding the ovary, indented adjaeent to the staminal filaments
Disseminule	
Indehiseent fruitlets, the wall thin and papery, often ±transluеent, and covered with a erystal layer	Indehiseent fruitlets, the wall hard, bony, eorrugate and often resinous on the inner surfaee

Flowers in *Spyridium* are usually smaller than those in *Trymalium* and are arranged in loose or dense, compound-cymose inflorescences with cymose bracts; the cymose pattern is maintained to the base of the inflorescence. In some species the cyme branching is highly contracted, resulting in dense, head-like inflorescences. Inflorescence-units in *Spyridium* are often subtended by floral leaves, which are covered with a conspicuous, showy, white indumentum. Flowers in species of *Trymalium* are more loosely arranged, with unit-cymes of the inflorescence often grouped racemosely on little-branched axes, which are frequently arranged into higher-order panicles. Floral leaves are absent in *Trymalium*.

Spyridium daltonii and *S.* x*rannosissimum*, both have inflorescences with a clearly maintained cymose pattern throughout, as is illustrated for *Spyridium* in Thiele and West (2004, Tab. 1). The inflorescences are more open than in typical species of *Spyridium*, and the peduncles of the unit-cymes are elongated [a situation that also occurs in other species, *e.g.*, *S. gnnnii* (Hook. f.) Benth. and *S. globulosum* (Labill.) Benth.]. This loose arrangement of flowers might have been one reason for Mueller to place *S. daltonii* into *Trymalium*. The actual flowers, however, are ±sessile. Some flowers in *S. daltonii* appear to be pedicellate, but these are better interpreted as one-flowered unit-inflorescences, since each flower is immediately subtended by 2–3 cymose bracts. Flowers in *Trymalium* have a true pedicel with the cymose bracts located at the base.

Spyridium flowers have a short, free hypanthium tube and a glabrous, shelf-like disk attached high on the hypanthium wall and notched adjacent to the staminal filaments (see Thiele & West 2004). A free hypanthium tube is absent in all species of *Trymalium*, with the exception of *T. urceolare* (F. Muell.) Diels (Rye 1995). The disc in *Trymalium* consists of a glabrous, thickened ring that immediately surrounds the ovary and is also indented adjacent to the staminal filaments. The two species from the Grampians have a spyridioid disc, and a very short hypanthium tube. Similarly, all species of *Trymalium* have a deeply branched style and more or less flattened petals, whereas the two Victorian species have an undivided, 3-lobed style and distinctly cucullate petals, both of which are characters typical for *Spyridium*.

The fruit in both genera is similar. Rye considers the genera *Trymalium* and *Spyridium* to be closely related on the basis of shared fruit characters, namely the presence of "indehiscent fruitlets that are released with their enclosed seed when the schizocarp dehisces" (Rye 1995: 119–120). The texture of the disseminule, the fruitlet, is an important difference between the two genera. The walls of the fruitlets of *Spyridium* are papery and covered with a crystal layer, whereas in *Trymalium* it is hard with a corrugated and often resinous inner surface. The fruits of *S. daltonii* consist of indehiscent fruitlets that have a crystal layer between the fruitlet wall and the hypanthium wall. The texture of the fruitlet wall is somewhat tougher than usually in *Spyridium*, but not as indurate as in *Trymalium*. The fruitlets are finely corrugated on the inner surface, but not resinous. As such, they appear superficially similar to fruitlets in *Trymalium*. The fruitlets contain a seed with a very small basal, yellow, translucent aril. *S.* x*rannosissimum* does not produce mature fruits (see above).

Thiele and West (2004: 827) described the seeds of *Spyridium* as "lacking an aril". This is in error (see also Rye 1995 and Walsh 1999a). Arils in *Spyridium* are rudimentary, very small, easily detached, usually yellow-translucent in colour, and often remain stuck inside the fruitlet when the seed is dissected out. As such, the seed does appear not to have an aril. Arils in *Trymalium* are also small and easily detached.

The morphological characteristics of *S. daltonii* and *S.* x*rannosissimum* clearly place the two species in *Spyridium* and corroborate the results of the molecular analyses. Mueller's placement of *S. daltonii* in *Trymalium* seems to have been based more on the overall appearance of the plant, i.e., the large shrubby habit, open inflorescences and yellowish flowers. Audas (1921a) recognised that *S.* x*rannosissimum* is closely related to *S. daltonii*. However, he did not examine the generic placement of the two species of

Trymalium in Victoria, despite the fact that the two botanists that he asked for advice on *S.* x*ramosissimum* did provide him with different opinions on the generic placement of the new species: J.M. Black informed him, that the taxon is a species of *Spyridium*; A.J. Tadgell opted for *Trymalium*.

Key to the species of *Spyridium* in Victoria

The addition of two more species to *Spyridium* makes it necessary to revise the key to the Victorian species in the genus published in the *Flora of Victoria* (Walsh 1999a).

1 Leaf tips toothed, notched or deeply cleft, no longer than 12 mm; rare shrubs of Little Desert, Grampians or East Gippsland 2
1: Leaves entire or if ever emarginate, at least some longer than 12 mm 3

2 Leaves obovate, 3-toothed at apex; margins plane to slightly recurved; leaves all greyish pubescent above and below; Grampians and East Gippsland heaths ..... ***S. cinereum***
2: Leaves deeply cleft, Y-shaped; margins strongly recurved; normal leaves glabrescent on upper surface; southern fringes of Little Desert ..... ***Spyridium*** sp. **1**

3 Surfaces of leaves shining from a covering of appressed silky hairs; rare, spindly shrub of southern Big Desert near South Australian Border .....***S. nitidum***
3: Leaves glabrous or pubescent, but not with shining appressed hairs 4

4 Floral leaves white-felted, differing from stem leaves (very rarely stem leaves felted in *S. parvifolium*) 5
4: Floral leaves not noticeably different from stem leaves, or only sparsely pubescent .. 6

5 Leaves orbicular to obovate, usually wrinkled above and with prominent lateral venation; widespread shrub ..... ***S. parvifolium***
5: Leaves linear to narrow-elliptic, neither wrinkled above nor with prominent lateral venation; shrub of western heaths ..... ***S. vexilliferum***

6 Leaves linear to narrow elliptic, sharp pointed or mucronate, glabrous; margins revolute, undersurface not visible, but midrib exposed in *S. daltonii* 7
6: Leaves oblong to narrowly elliptical or narrowly ovate to narrowly obovate, apex obtuse to acute (but not sharp pointed); margins recurved to revolute but undersurface usually visible 8

7 Flowers in dense, terminal, shortly pedunculate heads; leaves strongly revolute, lower surface always hidden; Mallee, also near Bacchus Marsh and Maffra ..... ***S. eriocephalum***
7: Inflorescence open, in cymose panicles; lower surface of leaves obscured, but midvein visible; Grampians ..... ***S. daltonii***

8 Leaves oblong or narrowly ovate to narrowly obovate, covered with greyish, fine stellate hairs, at least when young; flowers crowded near branch tips, rarely in sessile, terminal heads; Mallee, north-western Victoria ..... ***S. subochreatum***
8: Stem leaves narrow elliptic (or broader), upper surface usually glabrous and with impressed lateral veins; floral leaves sometimes covered with sparse indumentum; inflorescence in short, few-flowered panicles; Grampians, normally in areas where *S. parvifolium* and *S. daltonii* are present ..... ***S.*** x***ramasissimum***

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References

Audas, J.W. (1913). One of nature's wonderlands – the Victorian Grampians. *Victorian Naturalist* **29**, 146–155.

Audas, J.W. (1914). The Grampians revsited. *Victorian Naturalist* **31**, 24–29.

Audas, J.W. (1919). Nature in the Serra Range. *Victorian Naturalist* **35**, 171–177.

Audas, J.W. (1920). Through the Murra Murra country (western Grampians). *Victorian Naturalist* **37**, 59–65.

Audas, J.W. (1921a). Description of a new *Trymalium* (N.O. Rhamnaceae), *Trymalium ramosissimum*. *Victorian Naturalist* **38**, 34–35.

Audas, J.W. (1921b). Through the Balangum Ranges and at the Rose's Gap (Grampians). *Victorian Naturalist* **38**, 4–8, 11–16.

Audas, J.W. (1922). A circuit of the Grampians. *Victorian Naturalist* **39**, 87–95.

Audas, J.W. (1925). *One of nature's wonderlands: the Victorian Grampians*. Ramsay: Melbourne.

Audas, J.W. (1950). *The Australian Bushland*. W.A. Hamer: North Melbourne.

Bentham, G. (1863). Rhamneae, in *Flora Australiensis, a description of plants of the Australian territory* **1**, 409–445. L. Reeve & Co.: London

Canning, E.M. and Jessop, J.P. (1986). Rhamnaceae, in J.P. Jessop and H.R. Toelken (eds), *Flora of South Australia* **2**, 807–821. The Flora and Fauna of South Australia Handbooks Committee: Adelaide

Costermans, L. (1981). *Native trees and shrubs of south-eastern Australia*. Rigby: Adelaide.

Ewart, A.J. (1931 [1930]). *Flora of Victoria*. Melbourne University Press: Parkville.

Greuter, W., McNeill, J., Barrie, F.R., Burdet, H.M., Demoulin, V., Filgueras, T.S., Nicolson, D.H., Silva, P.C., Skog, J.E., Trehane, P., Turland, N.J. and Hawksworth, D.L. (eds) (2000). *International Code of Botanical Nomenclature (Saint Louis Code) adopted by the Sixteenth International Botanical Congress St. Louis, Missouri, July – August 1999*. Koeltz Scientific Books: Königstein.

Hooker, J.D. (1855 [1860]). Rhamneae, *Flora Tasmaniae* **1**, 69–78. Reeve: London

Kellermann, J., Udovicic, F. and Ladiges, P.Y. (2005). Phylogenetic analysis and generic limits of the tribe Pomaderreae (Rhamnaceae) using internal transcribed spacer DNA sequences. *Taxon*.

McCann, I.R. (1994). *The Grampians in flower*. Victorian National Parks Association: East Melbourne.

Medan, D. and Schirarend, C. (2004). Rhamnaceae, in K. Kubitzki (ed.), *The Families and Genera of Vascular Plants* **6**, 320–338. Springer: Berlin & Heidelberg

Mueller, F. (1882). *Systematic Census of Australian Plants with Chronologic, Literary, and Geographic Annotations. Part I. Vasculares*. M'Carron, Bird & Co.: Melbourne.

Ross, J.H. (1996). *A census of the vascular plants of Victoria* (5th edition). National Herbarium of Victoria, Royal Botanic Gardens Melbourne: South Yarra.

Rye, B.L. (1995). New and priority taxa in the genera *Spyridium* and *Trymalium* (Rhamnaceae) of Western Australia. *Nuytsia* **10**, 119–140.

Thiele, K.R. and West, J.G. (2004). *Spyridium burragorang* (Rhamnaceae), a new species from New South Wales, with new combinations for *Spyridium buxifolium* and *Spyridium scortechinii*. *Telopea* **10**, 823–829.

Walsh, N.G. (1999a). *Spyridium*, in N.G. Walsh and T.J. Entwisle (eds), *Flora of Victoria* **4**, 115–120. Ineata Press, Port Melbourne

Walsh, N.G. (1999b). *Trymalium*, in N.G. Walsh and T.J. Entwisle (eds), *Flora of Victoria* **4**, 109–110. Ineata Press, Port Melbourne

Willis, J.H. (1972). *A handbook to plants in Victoria* **2**. Melbourne University Press: Parkville.

Muelleria 22: 105–109 (2005)

A new endemic species of *Hibbertia* (Dilleniaceae) from Tasmania

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Abstract

Hibbertia basaltica A.M.Buchanan & R.B.Schahinger from southern Tasmania is newly described and illustrated, and its habitat and conservation status discussed.

Introduction

Hibbertia is a genus with more than 115 speeies, found mainly in Australia (all states and mainland territories), but also in Madagascar and some Paeifie islands (Toelken 1996; Harden & Everett 2000). In Tasmania, 14 speeies of *Hibbertia* are eurrently reeognised, ineluding one endemic (*H. hirsuta* (Hook.) Benth.) and one that is presumed extinet (*H. rufa* N.A.Wakef.) (Curtis & Morris 1975; Toelken 1998, 2000; Buehanan 2005).

In February 1999, botanist Andrew North eolleeted an indigenous *Hibbertia* speeies from a native grassland remnant near the historie town of Pontville in southern Tasmania (North 1999). The taxon was reeognised at the time as differing from other Tasmanian species in its stamen arrangement and pedunculate flowers (North, pers. eomm.). An examination of fresh flowering and fruiting material eollected by the authors in 2004 and during extension surveys in the greater Pontville area (RBS), has allowed us to formally deseribe the taxon as *H. basaltica* A.M.Buehanan & R.B.Sehahinger, and provide an aeeount of its distribution, habitat and eonservation status.

Taxonomy

Hibbertia basaltica A.M.Buehanan & R.B.Schahinger, *sp. nov.*

Hibbertiae pedunculatae similis sed staminibus quaternis, quinis vel rare usque ad septina aggregatis singuloque his in latere postieo earpellorum duorum dispositis illo antieo differt.

Type: Tasmania, old quarry near ford, Ford Rd, Pontville, *A.M. Buchanan*, 8 Oet. 2004 (holotype: HO 527774; isotype AD).

Prostrate to proeumbent *subshrub*. *Branches* to 40 cm long with a sparse covering of short stellate hairs and seattered or absent simple hairs. *Leaves* alternate, shortly petiolate, with axillary tufts of hair, linear-oblong, 3–6 mm long and 1–1.6 mm wide, with seattered forward-direeted simple aeieular hairs above and sparse short simple and stellate hairs below, beeoming glabrescent with age; apex blunt with a terminal tuft of hairs; margins entire, revolute almost to the broad midrib; eentral vein usually eonfluent with the apieal margins. *Flowers* 5-merous, solitary and peduneulate, terminating numerous short lateral branches. *Peduncles* to 20 mm long, reeurved at fruiting stage, with a moderate eovering of short stellate hairs and very occasional longer simple hairs; bract single (rarely 2) attaehed in the middle to lower third, flat, narrow-elliptie, 1.5–3.0 mm long, with simple and short stellate hairs. *Sepals* imbricate, spreading, persistent, the two outer ones narrow-ovate, 4.5–5 mm long by 2.5–3 mm wide, the three inner ones oblong-ovate and slightly shorter; the exposed outer surfaees of sepals (i.e., prior to anthesis) bearing long

simple and short stellate hairs, the membranous marginal surfaces glabrous; the unexposed outer surfaces with a dense cover of short stellate hairs; inner surfaces glabrous below but with scattered short stellate hairs and simple hairs near the apex. *Petals* obcordate, 7.5–10 mm long, yellow, caducous. *Stamens* arranged in two groups on opposite sides of the carpels, (3–)4–5(–7) on the posterior side and 1 on the anterior side, erect, the filaments in the former group joined only at the very base; anther and filament ± equal, their combined length c. 3.5 mm; anthers dehiscing by vertical slits. *Carpels* 2, fused at base; ovaries shortly pubescent with 4(–5) ovules in each; *styles* attached at the dorsal apex of each ovary, spreading and erect, c. 3 mm long. *Seeds* subglobular, 1.5–2 mm diam., smooth, reddish-brown. **Basalt guinea flower.** Figs 1–3.

Etymology: The species is named after its preferred substrate, Tertiary basalt.

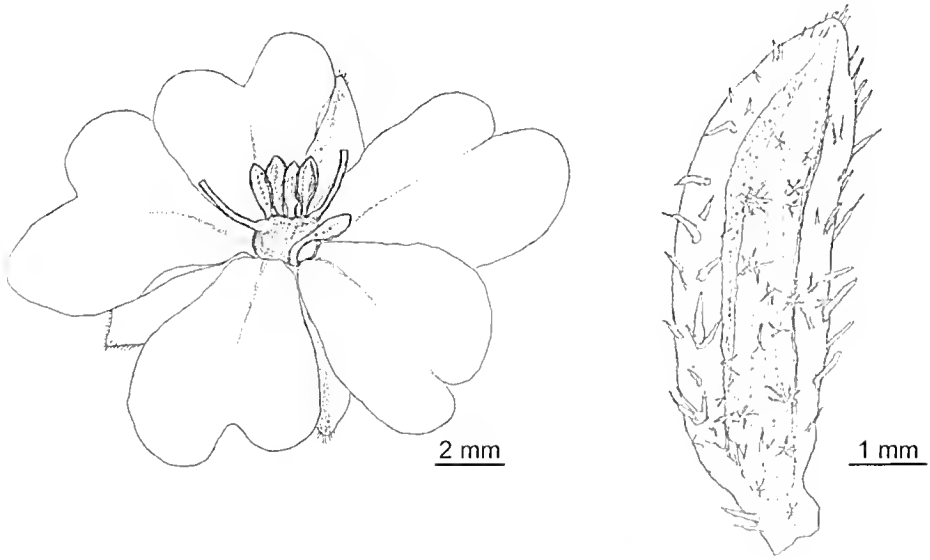

Figure 1. *Hibbertia basaltica*. Flower at anthesis and dorsal leaf surface. (Schahinger HO 530837)

Figure 2. *Hibbertia basaltica*. Flowering branchlet and seeds. (Schahinger HO 530838)

Figure 3. *Hibbertia basaltica* habit and habitat at Pontville, Tasmania.

Additional Specimens Examined: **TASMANIA**: Old quarry near ford, Ford Rd, Pontville, A. Buchanan, 8 Oct. 2004 (HO 527775; AD); 'Horses Head', E side of the Jordan River, c. 2 km SSW of Brighton, R. Schahinger, 27 Oct. 2004 (HO 529454; AD); 1 km S of Brighton, on slopes above Jordan River (E side), R. Schahinger, 6 Dec. 2004 (HO 529455; AD); Bagdad Rivulet, upstream of ford across Jordan River, R. Schahinger, 26 Oct. 2004 (HO 530837); S of ford across Jordan River, Pontville, R. Schahinger, 13 Oct. 2004 (HO 530838 & HO 530839).

Distribution and Ecology: Hibbertia basaltica is known only from the Pontville–Brighton–Bridgewater area in southern Tasmania (Fig. 4), where it is associated with rocky basalt outcrops on slopes above the Jordan River. Several patches have been recorded along a 7 km stretch of river, with an altitude range of 15 to 45 m. The species occurs in native grassland dominated by *Themeda triandra* Forsskal. (Kangaroo grass) and *Austrostipa* spp. (Spear grasses), with the occasional tall shrub *Bursaria spinosa* Cav. (Prickly box); the proportion of surface rock and lichen cover is high.

Phenology: Hibbertia basaltica flowers from late September to late November, peaking in mid-late October; seed is mature by mid-December.

Conservation Status: Population parameters for *Hibbertia basaltica* are as follows: number of known subpopulations, 3 (with 1,2 and 5 discrete patches, respectively); linear extent, 5.5 km; extent of occurrence, 2.9km^2; area of occupancy, 4-5 ha; number of mature individuals, c. 2500.

The conservation code for *Hibbertia basaltica* according to the ROTAP criteria of Briggs and Leigh (1996) is **2ECi**, while the species qualifies for listing as endangered on both the Tasmanian *Threatened Species Protection Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Seven of the eight known *Hibbertia basaltica* patches occur on private property and are under threat from land clearance, woody weed invasion (Gorse and Briar rose), and over-grazing by sheep and cattle; five of the patches are threatened by the likely future expansion of a major quarry. The eighth patch is mostly within a 3.2 ha parcel of Crown Land but it too is threatened by woody weed invasion, while the recent subdivision of adjoining land for residential use is also likely to have an impact through 'edge' effects. The taxon's extremely small area of occupancy — with the largest known patch c. 1 ha — also leaves it open to unforeseen stochastic events, such as the threat of prolonged drought.

Figure 4. Distribution of *Hibbertia basaltica* in Tasmania.

Considerable areas of *Hibbertia basaltica* habitat in the Pontville–Bridgewater area have been cleared over the past 200 years for agricultural, residential and light industrial purposes. Only small remnants of native grassland on basalt remain, typically on land considered too rocky for development.

Discussion

The species of *Hibbertia* in Tasmania fall into two groups, those with *stamens in a single cluster on one side of the two carpels*, and those with *stamens surrounding the carpels* (Curtis & Morris 1975; Toelken 1996).

Hibbertia basaltica does not fall within either of these groups, its stamens being arranged in two clusters (of 4–5 and 1) on opposite sides of the two carpels. The species is distinguished further by its pedunculate flowers (with a single bract attached in the middle to lower third of the peduncle), its procumbent habit, and its vestiture of stellate and simple hairs. The unique stamen arrangement of *H. basaltica* was found to be consistent across the populations in the Pontville–Bridgewater area, and it is concluded that the taxon represents a distinct and localised species.

Hibbertia basaltica resembles *H. pedunculata* (*sensu* Toelken 1996) in its mostly procumbent habit and in its long-pedunculate flowers. However, it differs in the number and arrangement of the stamens, having 8 at most, instead of 16–25 as in *H. pedunculata*. The arrangement, with only a single stamen on one side of the 2 carpels and usually 4–5 on the opposite side, is diagnostic. It differs further in the size of the petals, 7.5–10 mm long, twice the size of those in *H. pedunculata* in Victoria. *Hibbertia pedunculata* is not known from Tasmania.

Acknowledgments

We are grateful to Andrew North for providing information on known and potential *Hibbertia basaltica* sites in the Pontville area, and to Hellmut Toelken (AD) for helpful comments on the original material collected from the Pontville site in 1999. Tony Orchard and Gintaras Kantvilas kindly assisted with the Latin diagnosis.

References

Briggs, J.D. and Leigh, J.H. (1996). *Rare or threatened Australian plants*. Australian Nature Conservation Agency, Canberra.

Buchanan, A.M. (2005) (ed.). *A Census of the Vascular Plants of Tasmania & Index to the Student's Flora of Tasmania*. Fourth Edition. Tasmanian Herbarium Occasional Publication 7 Tasmanian Museum and Art Gallery, Hobart.

Curtis, W.M. and Morris, D.I. (1975). *The Student's Flora of Tasmania. Part 1* (Second Edition). Government Printer, Hobart.

Harden, G.J., and Everett, J. (2000). 'Dilleniaceae', in G.J. Harden (ed.), *Flora of New South Wales Revised Edition* **1**, 293–303. University of New South Wales Press Ltd, Sydney.

North, A. (1999). *Jordan River Catchment – Assessment of Biological Conservation Values and Identification of Management Priorities*. A report prepared for the Brighton and Southern Midlands Councils forming part of the Jordan River Catchment Management Plan.

Toelken, H.R. (1996). '*Hibbertia*', in N.G. Walsh and T.J. Entwisle (eds), *Flora of Victoria* **3**, 300–315. Inkata Press: Melbourne and Sydney.

Toelken, H.R. (1998). Notes on *Hibbertia* (Dilleniaceae) 2. The *H. aspera – H. empetrifolia* complex. *Journal of the Adelaide Botanic Gardens* **18(2)**, 107–160.

Toelken, H.R. (2000). Notes on *Hibbertia* (Dilleniaceae) 3. *H. sericea* and associated species. *Journal of the Adelaide Botanic Gardens* **19**, 1–54.

Muelleria 22: 111–112 (2005)

Lectotypification of *Sclerolaena glabra* (F. Muell.) Domin (Amaranthaceae/Chenopodiaceae)

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Introduction

When describing *Keutropsis glabra* (= *Bassia glabra* (F. Muell.) F. Muell., now *Sclerolaena glabra* (F. Muell.) Domin), Mueller (1859) cited a single locality – '*Ad rivum Sturt's Creek, Australiae subcentralis*'. However, Mueller's Sturts Creek collection at MEL of *S. glabra* consists of a mixture of two forms, clearly collected from different plants. One form Mueller apparently regarded as 'typical' and matches his original description. The other form Mueller referred to on a separate label as '*β longispinis*' has longer fruit with longer spines. The latter name was never published, but fruits agreeing with this form were illustrated as *Bassia glabra*, along with the 'typical' form in Mueller (1891) without further reference.

Subsequently, material representing the two elements was mounted, along with their respective labels, on separate sheets at MEL. Later workers have variously regarded these as syntypes of *Bassia glabra* (J.H. Willis 1948 *in sched.*) or specimens of *Sclerolaena glabra* and *S.* sp. nov. (E.H. Ising 1963 *in sched.*). The latter determination applied to Mueller's 'var. *longispinus*' specimen. Ising never formalised Mueller's name for want of sufficient material (note *in sched.*), but from comparison with other material at MEL this form falls within the range of specimens now regarded as *S. glabra* (including specimens determined by Ising, Paul G. Wilson and others).

Mueller's 'typical' specimen represents what now appears to be the shorter-awned end of the spectrum of variation within *S. glabra*, whereas his 'var. *longispinus*' specimen is more representative of the majority of modern *S. glabra* collections.

Wilson (1984) cited as the holotype for *S. glabra* 'Sturt Creek, W.A., 1856, F. Mueller (MEL)'. More correctly both MEL sheets should have been regarded as syntypes. As the two sheets represent distinctly different forms of *S. glabra* the opportunity is here taken to lectotypify on Mueller's 'typical' (unfortunately less representative) specimen and treat the 'var. *longispinus*' sheet as an excluded syntype.

Taxonomy

Sclerolaena glabra (F. Muell.), Domin, *Beitrage zur Flora und Pflanzengeographie Australiens* 624 (1930).

Kentropsis glabra F. Muell., *Fragmenta Phytographiae Australiae* 1: 139 (1859); *Anisacantha glabra* (F.Muell.) Benth., *Flora Australiensis* 5: 200 (1870); *Bassia glabra* (F.Muell.) F.Muell., *Systematic Census of Australian Plants*: 30 (1882). T: '*Ad rivum Sturt's Creek, Australiae subcentralis*', F. Muell. 1856; lecto (here chosen): '*Sturt's Creek*, Ferd. von Mueller, 1856' MEL 101453; excluded syntype: '*Sturt's Creek*, Ferd. Mueller' MEL 101452.

Acknowledgements

I am grateful to my colleagues Margaret Corrick and Nina Sawtell for bringing this matter to my attention.

References

Mueller, F. (1859). *Fragmenta Phytographiae Australiae*, vol. 1, Government Printer, Melbourne.

Mueller, F. (1891). *Iconography of Australian Salsolaceous Plants*, Government Printer, Melbourne.

Wilson, P. G. (1984). Chenopodiaceae *in* A.S. George (ed.) *Flora of Australia* 4: 81–317, Australian Government Printing Service, Canberra.

Muelleria 22: 113–118 (2005)

Vale Dennis Morris, 1924-2005

Gintaras Kantvilas

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Dennis Ivor Morris was born on 16 May 1924 in Tunbridge Wells, England, and educated there at the Worshipful Company of Skinners School. Those who worked with him and professed to know him well learned little of these early years of his life, although it was clear that he had received a remarkably broad education. His interests spanned all fields of learning, and he was able to quote as eloquently from the Bible as he was from the classics, and whether a discussion concerned history, geography, culture or science, Dennis could be relied upon to make some learned contribution. He was the totally educated man.

His life's experiences were many and varied. As a young man, he served in the British and Indian armies (1942-1947), attaining the rank of Captain. He also undertook forestry and farm work in England. In 1950, he emigrated to Australia and worked for a year on a sheep station in western Queensland, followed by a brief stint in British Columbia (Canada) as a surveyor. He returned to Australia in 1952 to work as a surveyor with the Hydro-Electric Commission of Tasmania. In 1954, he commenced employment with Tasmania's Scenery Preservation Board as a Park Ranger at Mount Field. It was during this time he met and married Phyll Doolan and together they had a daughter, Catherine. Dennis then worked as Manager of historic Entally House in the north of the State.

Dennis had no formal training in botany but he entered the field with some very valuable attributes. He had a passionate interest in the subject and a very keen eye. He

was also a gifted illustrator. In 1961, he was appointed to the Tasmanian Department of Agriculture as a Technical Officer, responsible for the identification of agricultural weeds and for contributing advice for their control. In this post, he saw a lot of Tasmania and Tasmanians, but, more importantly, he became familiar with Tasmania's introduced flora. This soon developed into a unique, specialist knowledge. These early years were marked by some small books on weeds that he co-authored and illustrated; for example, *The Noxious and Secondary Weeds of Tasmania* and *Tasmanian Weed Handbook* (both with B. Hyde-Wyatt).

The beginning of his partnership with Winifred Curtis in the early 1970s saw Dennis' development as a taxonomist. When questioned about their meeting in later years, neither recalled any apocalyptic or dramatic meeting of kindred spirits - rather, whilst on an excursion to Mt Wellington near Hobart, they simply 'met' and Dennis offered his help in the compilation of the *Students Flora of Tasmania*. Much has been written about the co-operation between the two. Their names are indelibly inscribed in the history of Tasmanian Botany, thanks to their assiduous efforts to complete the publication of this fundamental handbook on Tasmania's flowering plants and conifers.

Dennis learned much from Winifred, but he also brought to the partnership a skill and penchant for groups for which she had little liking, especially the weeds and the monocotyledons. Often when presented with some baffling grass or exotic for identification, she would gleefully remark: "Oh, I don't know those; I'm leaving those for Dennis". It was also Dennis who pursued the literature, tracking down old, overlooked names and long-unstudied type specimens, did the tough spadework where the rules of botanical nomenclature were concerned, and wrote the formal descriptions of new species. In this area, he became something of a local specialist, widely consulted and approached for assistance by younger colleagues. Although initially he was very much the assistant in the *Flora* project, in later years it was he who carried it through to completion; the final volume, published in 1994, was very much his work. Likewise, he was the driving force behind the revisions of existing volumes. He also brought great warmth and friendship to the partnership, and to Winifred's, at times, rather austere world. Despite Winifred's increasing frailty, and, in later years, his own illness, he maintained their regular, close contact throughout his life.

Dennis and Winifred worked together at the Herbarium, even before it was formally the Tasmanian Herbarium, at a time when it was only a room full of specimens on the top floor of the University's Botany Department. Having taken early retirement from the Department of Agriculture in 1985, the Herbarium became Dennis' 'job'. Few institutions could boast having the services of such a capable volunteer. It is a sad indictment of the way the world is, that sometimes we are unable to really pursue the profession we love until retirement, despite our skills and gifts. Likewise it seems inevitable that institutions such as herbaria will always be chronically under-resourced, and so will rely on volunteers to undertake much of the essential work. In Dennis' case, he completed approximately three decades of voluntary service– surely something of a record. He would often cheekily remark that he "couldn't be sacked". He saw many changes over those years: staff grew, the responsibilities of the Herbarium expanded, and various major projects commenced and were completed. Through all this, as Honorary Botanist, Dennis involved himself in all aspects of the Herbarium's activities; his was not a life of just working at his own projects. On his three work days each week, he was inevitably first in, turning on lights and heaters for other staff, and ensuring that the urn was filled for the ritual morning tea. The weed enquiries continued to be brought to him, he did work for the Police and for Quarantine Officers, taught plant identification classes at the University's School of Agricultural Science, and helped with the curation of the collection. When projects such as Australia's Virtual Herbarium commenced in 2001, Dennis personally revised the determinations of thousands of specimens. On Herbarium Open Days he was an integral part of proceedings, on occasion serving as a display of a

Dennis Morris: as a British Army officer in 1944 (top left); on the occasion of the awarding of his DSc in 2003 (top right, photo T. McManus); with his life-long friend, colleague and co-worker on the *Students Flora* project, Dr Winifred Curtis in c. 2000 (bottom, photo T. McManus).

'botanist at work'. He personally contributed about 2,500 specimens to the collection, although his greatest efforts were directed to the identification of specimens brought in by others.

It is no exaggeration to say that Dennis was the life of the Herbarium. His stories, drawn from his rich life's experiences and always delivered in the appropriate accent, be it Indian, country Tasmanian or Norfolk English, entertained many a tea-room gathering. His tales from India were particular favourites: Kipling-esque accounts of people shooting at each other but somehow with nobody of consequence ever getting killed. He would also engross himself in a huge, old *Websters Dictionary* (affectionately referred to as 'the Book of Morris'), frequently sharing some gem about the origin and meaning of an obscure word. In his work he asked for very little, and was content with his office and rather old microscope, but he was quietly appreciative when his beloved but tattered dictionary was professionally repaired and rebound.

Dennis' commitment to hard work and love of botany expressed themselves in many

aspects of his life, not least in his gardening. His home at Fern Tree, on the slopes of Mt Wellington, was a showpiece of Rhododendrons and other exotica - a regular destination for followers of 'Open Garden' events, and a regular recipient of awards or publicity. In later years, when he felt he didn't have the energy for it, he and Phyll moved to a smaller block in Kingston. However, in no time he was back outside, transforming a sandy yard with a huge sandstone outcrop into another beautiful garden.

As the years passed, Dennis' work load did not diminish. If anything, his skills were in ever-increasing demand, not only from his herbarium colleagues but also from botanists from other agencies, private environmental consultants, farmers, land managers, foresters, amateurs and indeed anybody with an interesting plant specimen or a challenging enquiry. He effectively provided a continuous, unpaid identification and advisory service. On many occasions, the State benefited enormously from his prompt action in identifying new weed incursions, his advice on rare species recognition, distribution and management, and his ongoing assistance to all. That so much knowledge on which the community depended, especially with respect to weeds, grasses, exotic plants and prohibited plants, rested on an inevitably though gracefully ageing Dennis was a great concern, to him and to his colleagues. Likewise, the responsibilities for the *Students Flora* project also weighed heavily upon him.

Some relief came in 2001, when, through the personal involvement of the then Departmental CEO, Jeff Kelly, a Graduate Trainee in Weeds was appointed to the Herbarium as an understudy to Dennis. The two developed a strong bond, and it eased some of the pressure on Dennis. Likewise, other staff changes gradually lifted some of the burden for the *Students Flora* from his shoulders, leaving him more free to potter with projects he really enjoyed.

A highpoint in his professional career came in December 2003, when he was awarded an Honorary Doctor of Science degree from the University of Tasmania. Dennis' had been a life of service outside of academia. Like so many other 'appreciated experts' he had devoted his energies to advancing the knowledge of others and had neither sought nor had the opportunity to pursue recognition for himself. His skills and contributions had been widely acknowledged in the community for decades, but at last they were formally recognised. The degree ceremony and subsequent reception in his honour brought a large contingent of his family, friends and colleagues together to share his pleasure in this deserved and long-overdue honour. Many may not have known, but he was already gravely ill.

Dennis dealt with ill-health in his usual, down-to-earth manner. The first diagnosis of illness was announced to his colleagues over a cup of tea, and then he continued with his work, interrupted only by periods of medical treatment. He died on 27 July 2005, an active, productive botanist – his lab coat draped over his chair ready for the next day, a pile of specimens next to his microscope and, on his desk, notes on a new lily he was describing. He felt he still had much left to do.

Dennis Morris's contributions to Tasmanian Botany are enormous. The species he recognised and described for the first time, the books and papers he wrote, and the knowledge he imparted to generations of students and fellow workers, will ensure that he will never be forgotten. He embodied that particular blend of knowledge, selfless service and modesty that endeared him to all. Those who looked to him as a teacher, a fellow scientist, or simply as a warm and kindly friend will miss him greatly.

Publications of Dennis Ivor Morris

Curtis W. M. & D. I. Morris (1975). *The Student's Flora of Tasmania Part 1*. 2nd Edition. St David's Park Publishing: Hobart.

Curtis, W.M. & Morris, D.I. (1994). *The Student's Flora of Tasmania: Part 4B*. St David's Park Publishing: Hobart.

Forbes, S.J. & Morris, D.I. (1996). A review of the *Erigeron pappocrouus* Labill.

complex. *Muelleria* 9: 175-189.
Guy, P.L., Johnstone, G.R. & Morris, D.I. (1987). Barley yellow dwarf viruses in, and aphids on grasses (including cereals) in Tasmania. *Australian Journal of Agricultural Research* 38: 139-152.
Hovenden, M.J. & Morris, D.I. (2002). Occurrence and distribution of native and introduced C_4 grasses in Tasmania. *Australian Journal of Botany* 50: 667-675.
Hyde-Wyatt, B.H. & Morris, D.I. (1980). *The Noxious and Secondary Weeds of Tasmania*. Tasmanian Department of Agriculture: Hobart.
Hyde-Wyatt, B.H. & Morris, D.I. (1975). *Tasmanian Weed Handbook: a Guide to the Identification of the Main Broad-leaf Weeds of Crops and Pastures in Tasmania*. Tasmanian Department of Agriculture: Hobart.
Johnson, L.A.S. & Morris, D.I. (1994). *Allocasuarina duncanii*, a new species in *Allocasuarina* section *Cylindropitys* (Casuarinaceae). *Telopea* 5: 793-794.
Lane, P., Morris, D.I. & Shannon, G. (1999). *Common Grasses of Tasmania. An Agriculturalists' Guide*. Tasmanian Environment centre: Hobart.
Morris, D.I. (1969). Rambling dock (*Rumex sagittatus*). *Tasmanian Journal of Agriculture* 40: 273.
Morris, D.I. (1971). Common chickweed in Tasmania - two species: *Stellaria media* and *Stellaria pallida*. *Australian Weeds Research Newsletter* 16: 12.
Morris, D.I. (1977). Miscellaneous notes on endemic Tasmanian plants in the genera *Olearia*, *Ixodia*, *Xyris*, *Danthonia*, *Tetrarrhena*. *Records of the Queen Victoria Museum* 55: 1-5.
Morris, D.I. (1978). *Ammi majus* - a 'new' weed in carrots. *Tasmanian Journal of Agriculture* 49: 223-224.
Morris, D.I. (1981). New records for Tasmania. *Australian Weeds* 1: 34.
Morris, D.I. (1983). *Stipa brachychaeta*, a weed new to Tasmania. *Australian Weeds* 2: 172.
Morris, D.I. (1990). New taxa and a new combination in Tasmanian Poaceae. *Muelleria* 7: 147-171.
Morris, D.I. (1991) *The Grasses of Tasmania*. Tasmanian Herbarium Occasional Publication No. 3. Tasmanian Museum and Art Gallery: Hobart.
Morris, D.I. (1991). '*Cryptandra exilis* sp. nov. (Rhamnaceae), a new species from eastern Tasmania' in M.R. Banks, S.J. Smith, A.E. Orchard & G. Kantvilas (eds), *Aspects of Tasmanian Botany - A Tribute to Winifred Curtis*. pp 57-58. The Royal Society of Tasmania: Hobart.
Morris, D.I. (1991). '*Restio hookeri* (Restionaceae), a new name for a familiar Tasmanian species, and reinstatement of *Ghania rodwayi* F. Muell. ex Rodway' in M.R. Banks, S.J. Smith, A.E. Orchard & G. Kantvilas (eds), *Aspects of Tasmanian Botany - A Tribute to Winifred Curtis*. pp 33-34. The Royal Society of Tasmania: Hobart.
Morris, D.I. (2001). A new species of *Oreobolus*, *O. tholicarpus* (Cyperaceae), endemic to Tasmania. *Muelleria* 15: 27-30.
Morris, D. I. (2004). *Laxmannia morrisii* Keighery (Anthericaceae) a synonym of *L. squarrosa* Lindl., not a native of Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 138: 35-36.
Morris, D.I. & Curtis, W.M. (1974). Recent additions to the Tasmanian flora and some notes on nomenclature. *Records of the Queen Victoria Museum* 50: 1-5.
Morris, D.I. & Duretto, M.F. (2005). A new species of *Bulbine* (Asphodelaceae) from Wilsons Promontory and islands of eastern Bass Strait. *Muelleria*.
Munday, B.L. & Morris, D.I. (1978). *Tasmanian plants toxic for animals*. Tasmanian Department of Agriculture: Hobart.
Rozefelds, A.C.F., Cave, L., Morris, D.I. & Buchanan, A.M. (1999). The weed invasion in Tasmania since 1970. *Australian Journal of Botany* 47: 23-48.
Watson, W.R. & Morris, D.I. (1973). Serrated tussock in Tasmania. *Tasmanian Journal*

of Agriculture 44.
Wilson, K.L. & Morris, D.I. (1993). *Lepidosperma curtisiae* (Cyperaceae), a new Australian species. *Telopea* 5: 423-425.

Additional illustrations published in:

Auld, B.A. & Medd, R.W. (1987). *Weeds: An Illustrated Botanical Guide to the Weeds of Australia*. Inkata Press: Melbourne.
Lamp, C.A., Forbes, S.J. & Cade, J.W. (1990). *Grasses of Temperate Australia: a Field Guide*. Inkata Press: Melbourne.

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Sincerely

Editor & Editorial Committee

CONTENTS

Volume 22 2005

Contributed Papers	Page
The lichen genus *Nephroma* in Australia – Simone HJJ. Louwhoff	3
New Victorian endemic species of *Poa* L. (Poaceae) – CM. Weiller, V. Stajsic, & NG. Walsh	11
Taxonomic studies in the *Grevillea victoriae* species complex (Proteaceae: Grevilleoideae) I. Descriptions of nine previously segregated, and three new taxa – V. Stajsic & WM. Molyneux	19
Large is better: the effects of floral display on reproductive success in two populations of *Caladenia (Stegostyla) gracilis* R. Br. – Raymond Tremblay	77
A new species of *Commersonia* (Malvaceae *s.l.*) from the Eyre Peninsula, South Australia – CF. Wilkin & BA. Whitlock	87
A new species of *Bulbine* (Asphodelaceae) from Wilsons Promontory and islands of eastern Bass Strait – Dennis I. Morris & M. Duretto	93
New combinations for two species of *Spyridium* (Rhamnaceae: Pomaderreae) from the Grampians, Victoria – J. Kellerman	97
A new endemic species of *Hibbertia* (Dilleniaceae) from Tasmania – AM. Buchanan & RB. Schahinger	105
Lectotypification of *Sclerolaena glabra* (F. Muell.) Domin (Amaranthaceae/Chenopodiaceae) – N. Walsh	111
Vale Dennis Morris, 1924-2005 – Gintaras Kantvilas	113
Note from the Editor	115